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Forthcoming Events.

OCTOBER 10.

Mining Institute of Scotland:—General meeting at Edinburgh.

OCTOBER 12.

Institute of Metals (Scottish Local Section):—Chairman's address, by John Stirling.

OCTOBER 13.

Sheffield Metallurgical Association:—Meeting at Sheffield. "Manufacture and Testing of High-speed Steels," Paper by J. F. Kayser.

Institute of Marine Engineers:—Ordinary meeting in London. "Metallic Corrosion," Paper by W. S. Patterson, M.Sc.

OCTOBER 14.

Institution of Civil Engineers:—Extra meeting in London. Discussion on "Standard Codes for Tabulating the Results of Trials on Steam Turbines and Condensing Plant," by R. A. Chattock.

OCTOBER 16.

The Institute of Metals (Swansea Local Section):—Meeting at Swansea. Chairman's address by Captain Hugh Vivian.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Foundry Trades Equipment & Supplies Association.

Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

The American Foundrymen's Association.

As this society is to be the host for an international foundrymen's convention, to be held in Detroit next autumn, we think it essential that British foundrymen should know something of its constitution, objects and activities. Primarily, it is not the only foundrymen's association in the United States, there being about nine local associations. There are in addition both national and local employers' federations. The association, covering as it does a vast continent, only holds one meeting each year, and with it is always held an exhibition covering equipment and material used in foundry practice. From this source a considerable revenue is derived. In membership the individual's firm is more stressed than is the case in Europe, whilst its adherents include those who supply foundries as well as those who operate them. A certain amount of feeling once existed as to this policy, but has been satisfactorily overcome without resorting to exclusion. The fact that an exhibition is usually held with the conventions provides a suitable place for the introduction of business topics. At the Exhibition which opened last Monday, there were no less than 174 separate stall holders, all of which were American except that of the British Aluminium Company.

The American Foundrymen's Association does a considerable amount of work by means of committees, the working of which we would imagine must be of considerable difficulty owing to the distances to be travelled. The bulk of the work, we understand, is done by correspondence, and members must be exceptionally enthusiastic to continue work on these lines. Eighteen committees cover the following activities:—Awards, convention and exhibits; papers, nominating; foundry costs, international relations; pattern equipment standardisation; moulding sands; ferrous metals advisory to the U.S. Bureau of Standards; steel castings; grey-iron castings; heat treatment of ferrous castings; corrosion; malleable castings; non-ferrous castings; refractories; coal and coke; and metallography. Apparently all the committees do not report each year, but some, such as that on moulding sand, present several reports through their sub-committees.

The Association attaches much importance to maintenance of good feeling with European foundry societies, and the annual exchange papers are accorded special prominence. Next year for the Detroit Convention there will be a new departure in the presence of a German delegation. We hope that this convention will be truly international to enable the representatives of the various societies of the world to arrange a mondially acceptable rota for the holding of international conventions, because so far as is known nothing further beyond Detroit is envisaged, and without international co-operation avoidable clashing may result.

A Description of the Perlit Process.*

By H. J. Young, F.I.C.

The presidential address of Mr. V. C. Faulkner, of the London Branch of the Institute of British Foundrymen, contained the following statement:—"Apart from one or two cases, the methods of production and the conditions existing now in foundries are no different from those of 20 years ago."

This Paper is a description of a new method of production of grey iron castings under new conditions; a process representing, in the author's opinion, the first distinct and definite advance in ordinary ironfoundry practice.

At the Glasgow Convention the author read a Note on Perlit Iron, and here, in his home Branch, this survey of the Perlit process is given in response to the requests of those who desire to go further into the matter.

For those unfamiliar with metallurgy, but conversant with practical ironfounding and engineering, the subject may be approached more easily, perhaps, by consideration of some common examples of ordinary castings.

Propeller Blades.

Firstly, consider that extreme case of a propeller—blades and boss complete in one casting—weighing, say, eight tons. Here it is found that the tip of a blade is whitish hard iron of a most brittle nature and unfit for the purpose to which it is put; some way up the blade the metal will be at its best—the exact position of this good metal depending upon the design of the blade and the composition of the molten iron—while at the root, namely, where the blade enters the boss of the propeller, the iron is weak, open and porous. Therefore it is evident that in one and the same casting the iron has varied from bad hard iron to bad soft iron, but *somewhere* in that casting the iron is good. No testbar can represent such a casting or tell anything about it; no engineer can estimate the strength of the propeller; as a matter of fact, what the engineer does is to count upon its weakness.

The cause of the trouble is as evident as its effects and all know that the cooling conditions of the casting, being out of control, play havoc with the iron. It is equally obvious that if those conditions were controlled so would be the final conditions of the metal. For example, the tips of the blade would not be too hard or too soft if caused to cool down at a rate proper to the particular composition of cast iron used.

Plain Castings.

Those who discovered the Perlit process and who did the experiments, which have rendered possible its useful application to industry, undoubtedly started off with some such idea in their minds as the above-described case of a propeller blade. Secondly, take the example of a plain bar or plate of, say, 2-in. casting-thickness. Such a casting, when fractured, has a chilled skin, where the metal touched the mould; next, an area of "close" metal and, finally, a "core" of metal of increasing "openness" towards the centre of the section. A testbar presents this appearance, with the result that if the bar is machined to 1 in. dia., it will give a very different tensile strength from that given if machined to ½-in. dia. Here, therefore, is repeated the propeller blade on a small scale, so that even a plain casting is unreliable and of varying quality across its section.

Globe Valve.

As a final instance, consider a casting such as a 2-in. globe valve, where there are several thicknesses and certain places where two or more sections meet, forming a considerable lump of solid metal. Such a casting, when split open, presents the astonishing spectacle of having a different grain in each section, a "core" in each section, and more or less "open" metal in the lumpy parts.

It is a fact, known to engineers, that a grey-iron casting, plain or intricate, is unreliable, owing to the peculiarities mentioned above. It is a fact, known to metallurgists, that this is the curse of cast iron and one which already is causing it to lose its position as a sound engineering proposition. Curiously enough, cast iron appears to stand alone as the one material of engineering construction with which little has been done on scientific lines. Steel, gunmetal, bronze, brass, aluminium alloys, white metals—all have had an immense amount of scientific investigation with the result that they are materials, understood, under control and ready to be improved by every new conception by scientific workers. Cast iron, on the other hand, is the Peter Pan among metals, it has never grown up. The work to be done, the fields before the British Cast Iron Research Association, and all other workers, are immense.

What happens during cooling to one piece of grey iron, happens to all iron which, when cooling from the liquid form, deposits free graphite. This means to say that all qualities of cast iron are at the mercy of the cooling conditions.

The absurdity and the seriousness of the position may be appreciated by imagining what would be said of a piece of steel, for instance, which was as variable as is a piece of cast iron. Suppose one wished to heat-treat a bar of tool-steel and knew that its carbon content varied all over; obviously, heat-treatment of steel would be a farce. In the same way, has it been impossible for metallurgists to heat-treat cast iron for the simple reason that any one piece of the material or any one casting presented a miscellaneous mixture of alloys of various combined and free carbon-contents and graphite- and grain-sizes. This aspect may not appeal to the foundryman, but it is of vital importance to engineering.

The Perlit process causes a casting of any composition of iron to cool throughout at a desirable and uniform rate. This is done by pre-heating the mould to that temperature, which, it has been ascertained, brings about the desired rate of cooling for the particular iron used.

To the metallurgist the idea is simple and practicable, but it is unlikely that anyone would guess the many other desirable effects which are brought about by the particular process of pre-heating the moulds.

Motor-Car Castings.

The iron thus produced has a remarkable resistance to impact. The other day, in a large motor-cylinder foundry, the author was shown the fracture of a bicycle cylinder. This fracture was obtained by breaking the casting by not more than four blows with a light hand-hammer. As it broke the author said to the manager:—"You could not have done that if it had been Perlit." Indeed, after getting accustomed to Perlit the brittleness of non-perlitised castings is amazing. This superior resistance to impact peculiar to perlitised iron may be due to one or all of several characteristics of such iron. For instance, the graphite voids are more curly and finer: the material is very homogeneous across its section and through all sections and, owing to its equable cooling and similar final composition throughout, casting strains are largely absent.

Another advantage of great importance is the reduction of wasters which is experienced, particularly in repetition castings. Taking it for granted that the foundry is accustomed to one particular design of casting, then that foundry will benefit, by the adoption of the process, through getting fewer wasters. Segregation of slag, dirt and gas inclusion, undue graphite growth, internal shrinkages, porosity and so on, are all reduced, with the result that the castings are not only better, but fewer of them are bad. The author knows of one class of casting where, in various foundries in this country, from 10 to 30 per cent. of wasters are got before the castings finally pass on to the job. The Perlit method would revolutionise this position because the majority of the defects are precisely those which are absent under the new procedure.

* A Paper read before the Newcastle Branch of the Institute of British Foundrymen.

The author thinks that a not unimportant point of the process is that the molten iron is not chilled as and where it touches the mould-surfaces. He thinks that this formation of a chilled skull of iron when using a cold mould is a disadvantage of greater magnitude than is apparent at first thought.

The engineer judges cast iron by the tensile test of a bar attached to, or cast separately from, the main casting. This bar no more represents the casting than does the tip or the root of a propeller blade represent the middle of the blade, or than could the "core" of that same testbar represent the metal surrounding that "core." At the same time, the engineer safeguards himself by ignoring the tensile test obtained and by applying a large safety factor and using heavy sections.

Let us take a particular instance. Make two castings—say, two globe valves—one by the Perlit process and the other in the ordinary manner. Each of these has a testbar attached and suppose each testbar gives, say, 11 tons per sq. in. What have we obtained? We have, in the case of the ordinary casting, a thing which varies in every section; indeed, is horribly weak in some parts. Also every section has a "core." Also when split open it will exhibit, in all probability, many defects. In the Perlit casting we have a homogeneous metal practically the same throughout, and if the testbar is cut out of it, it will give a test representing the whole casting. There is no choice between the two articles; one is a fantastic and crude production, while the other is something upon which the engineer can rely and base his calculations. The same conditions prevail if the iron is one giving 14 tons per sq. in. or 18 tons; the process applying equally to cast iron of all grades.

Lower Silicon Possible.

By the Perlit method it is possible now to make castings of iron containing less silicon than could be used in the ordinary way. Suppose, for example, that a motor cylinder is cast in a cold mould with metal containing, say, 1.7 per cent. silicon. We know, and every foundryman knows, that if that same casting is made from similar iron, but containing only, say, 1.2 per cent. silicon, the result is that the casting would be too hard and possibly white or mottled. Not so under Perlit conditions, as with a properly preheated mould a perfectly grey casting is obtained from 1.2 per cent. silicon iron. With equal facility can the phosphorus content be lowered.

The well-known metallurgist, Mr. J. E. Hurst, stated that it was a *fundamental* of the Perlit process that the iron used for a Perlit casting should be white if cast into the same casting in a cold mould. The author disagreed with Mr. Hurst, and the latter draws attention to Prof. Bauer's statement as follows:—"By the Perlit casting process it is possible to produce a grey iron on solidification from a pig-iron which under ordinary circumstances would solidify white." That it is *possible* to do this has been proved by the author; that it is a fundamental of the process is another matter altogether because it depends upon individual judgment and the requirements of the case. In a previous Paper the author stated that the moulds should be "as hot as convenient" and here again laid himself open to Mr. Hurst's criticism. The process is a practical proposition, and in some foundries or in some moulds it is better to alter the composition of the metal to suit the temperature most convenient for the foundry concerned or for the mould concerned, rather than to calculate the other way about. In some moulds, under the author's supervision at the North Eastern Marine Engineering Company, we found that we could use either a fairly low silicon-content combined with a certain mould temperature or a still lower silicon, combined with a higher mould temperature. We chose that combination which was found to be the more convenient.

The process cannot be judged by any personal interpretation of a particular wording. It is a practical process and, therefore, pliable—to practical conditions and limitations.

If one desires to obtain the highest possible perfection, it is merely necessary to increase the control over the conditions regulating composition and temperature; if one desires to cast grey Perlit iron, which in a cold mould would be perfectly white, it can be done, and the author frequently does it; on the other hand, if it is desirable to obtain the main benefits of the process without, at the same time, reaching perfection, as defined in an academic laboratory, that also can be done, and represents the great value of the process, namely, it is applicable commercially.

The lecturer then showed a large number of slides and concluded by inviting members to ask any questions they liked and he would answer them to the best of his ability.

Also he expressed his thanks to Mr. Summers Hunter and the North Eastern Marine Engineering Company, Limited, for permitting him to give this Paper.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

Foundry Equipment Business in the Dominions.

To the Editor of The Foundry Trades Journal.

Sir,—We read with great interest the report on the complimentary dinner to Mr. A. Moore and also Mr. O'Keefe's suggestion that British requisite firms should get together and employ one selling agency in Australia for their various lines.

We are quite surprised to hear that Mr. O'Keefe finds it difficult to make a market for his products in that country, as we have not had the least difficulty in introducing the requisite we manufacture, neither has any difficulty been experienced in the matter of keeping stocks out there.

In view of the tonnage we hold in stock out in Australia the statement contained in the letter from Mr. A. T. Alexander that only blacking, coal dust, brick dust and core gum are obtainable from stock out there is not correct—one other requisite at least can be added to that list, and prompt delivery given from stocks.

There may be something in Mr. O'Keefe's suggestion as to a central selling agency, but, so far as we are concerned, we have not hitherto found it necessary to seek assistance in placing our product in any British possession or in foreign countries either for that matter.—Yours, etc.,

Per pro Thomas E. Gray & Company, Limited,
Thos. H. Gray, *Director*.
119, High Holborn, London W.C.1.
October 2.

Colloidal Separations in Alloys.*

By Professor J. H. Andrew, D.Sc., and Robert Hay, B.Sc., A.I.C.

[Summary.]

The resolution of the Beta constituent of brass into its constituent phases alpha and gamma is dealt with, and a method of bringing this about referred to. It is suggested that the Beta constituent breaks down into colloidal alpha and colloidal gamma. Upon submitting the colloidal forms to an electrical current the colloid is thereby destroyed and the crystalline phase begins to make its appearance. It has further been suggested that the ageing of duralumin is due to the deposition of the magnesium compound in the colloidal form, and that the increase in hardness resulting from the ageing process is due rather to the fineness of state of division of the separating phase than to its specific properties.

A Correction.

We regret that in a recent issue we described Herr Karl Emmel as a Dr.-Ing. instead of "Direktor." We apologise for any annoyance which this has caused Mr. Emmel.

* From Institute of Metals, Autumn Meeting in Glasgow.

American Foundrymen's Association.

The twenty-ninth Convention of the American Foundrymen's Association opened last Monday

MR. A. B. ROOT, JUNIOR.

Mr. Root, who has been elected President of the American Foundrymen's Association, is the mechanical engineer to the Hunt-Spiller Manufacturing Corporation of Boston. Mr. Root was President of the New England Foundrymen's Association in 1918 and 1919, and a director of the American Foundrymen's Association in 1919-1920.

at Syracuse, under the presidency of Mr. A. B. Root, Jun. As is customary, the convention is associated with a foundry equipment exhibition, which is organised by the Association itself. As

MR. STUART W. UTLEY.

Mr. Utley has been elected Vice-President of the American Foundrymen's Association, and, it is expected, will preside over the International Congress to be held in Detroit next autumn, when a strong delegation of British foundrymen will take part. Mr. Utley is vice-president and general manager of the Detroit Steel Castings Company.

the Association only holds one meeting a year, a large number of Papers and reports had to be submitted, which rendered necessary the splitting up of the meetings into classified sessions, each dealing with a particular phase of foundry work. The annual exchange Paper with the Institute of British Foundrymen was presented in person by Mr. J. E. Fletcher, the consultant to the British Cast-Iron Research Association. Mr. Fletcher dealt with the co-relation of ferrous-metallurgical processes in a very interesting manner. Such studies are exceptionally useful in placing new developments in their proper perspective. Of great interest to Europe was the election of Mr. S. W. Utley as vice-president, as in the normal way he will preside over the International Conference, to be held in Detroit next autumn. Mr. Utley is the vice-president of the Detroit Steel Castings Company.

Of the thirty or more Papers which were read, a fair number of direct interest to the British foundry industry, and, on the whole, they are of a higher metallurgical standard than usual. Though the Americans have reached a high standard in the production of black-heart malleable, one can see a steady attack being made to reduce the time of annealing. We should not, however, be surprised to see the solution of this problem come from Europe, as many recent experiments on this side of the Atlantic have

DR. R. J. ANDERSON.

Dr. Anderson, who is to receive to-morrow the "William H. McFadden" Gold Medal of the American Foundrymen's Association, has an international reputation as an authority on light alloys, his recent book on Aluminium being a standard work on the subject. He presented in 1924 at the Newcastle Congress of the Institute of British Foundrymen an Exchange Paper on behalf of the American Foundrymen's Association.

given several useful pointers. We give elsewhere in this issue a selection of the Papers read, and future issues will cover the entire technical work of the conference. It is interesting to note that Mr. Oliver Smalley, the well-known British metallurgist, read a Paper on Wednesday to the Institute of Metals division on "Special Nickel Brasses."

Varnish for Wood Patterns.—Dissolve and well mix the following:—Shellac, ½ lb.; plumbago, ½ lb.; methylated spirits, 1 gallon. Before applying, always stir well.

MONS. G. MASSON, the President of the Association Technique de Fonderie de Belgique, draws our attention to the fact that the list we published of the papers to be read at the forthcoming Foundry Congress, to be held in Liege from October 25 to 28, omitted an American Exchange paper by Mr. J. W. Bolton, entitled, "On the Relation of the Constitution of Grey Iron to its Engineering Properties."

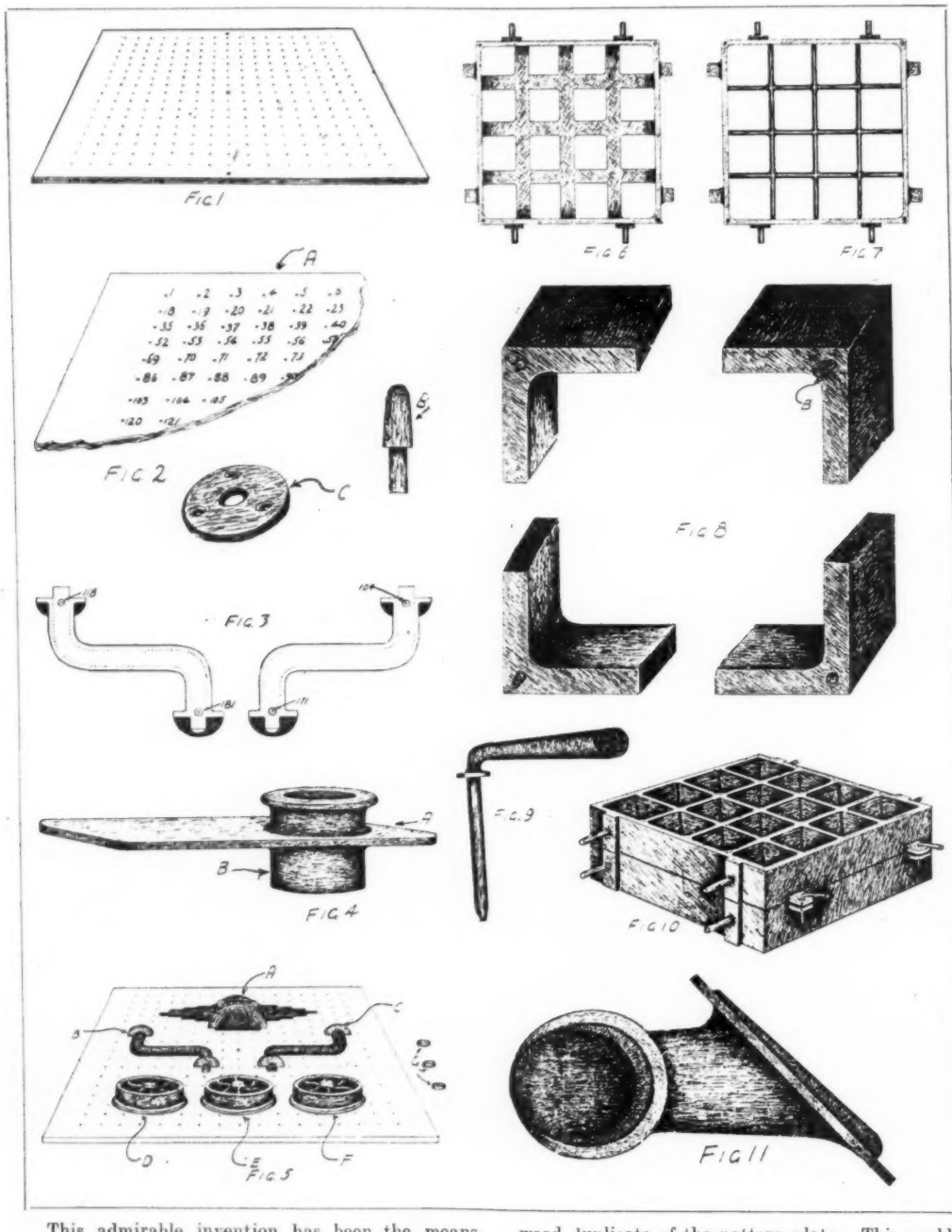
Some of the I.B.F. Branch Presidents.

Centre—Eng.-Commander L. Jackson, Sheffield; *Top Left*—Mr. G. C. Pierce, London; *Right Top*—Mr. H. Summersgill, West Riding of Yorkshire; *Bottom Left*—Mr. M. B. Herpst, Newcastle; *Bottom Right*—Mr. J. Masters, Lancashire.

Improved Foundry Tackle.

By H. V. Fell.

One of our most vital problems these days is undoubtedly high production costs, a reduction of which is necessary to permit of British competition with foreign countries. To achieve this end, there has been introduced into our foundries various types of hand and power moulding machines with their accessories. Of these accessories, outstanding merit must be accorded to the Vickers Patent Pattern Plate.



This admirable invention has been the means of reducing moulding costs to a great extent, and one of which foundry owners ought to take full advantage, owing to its suitability for use on any make of moulding machine; its adaptability, by which a large percentage of existing patterns can be used by merely altering the dowel arrangements, and the means it affords by enabling the whole area of the plate capacity to be utilised.

Description of Plate.

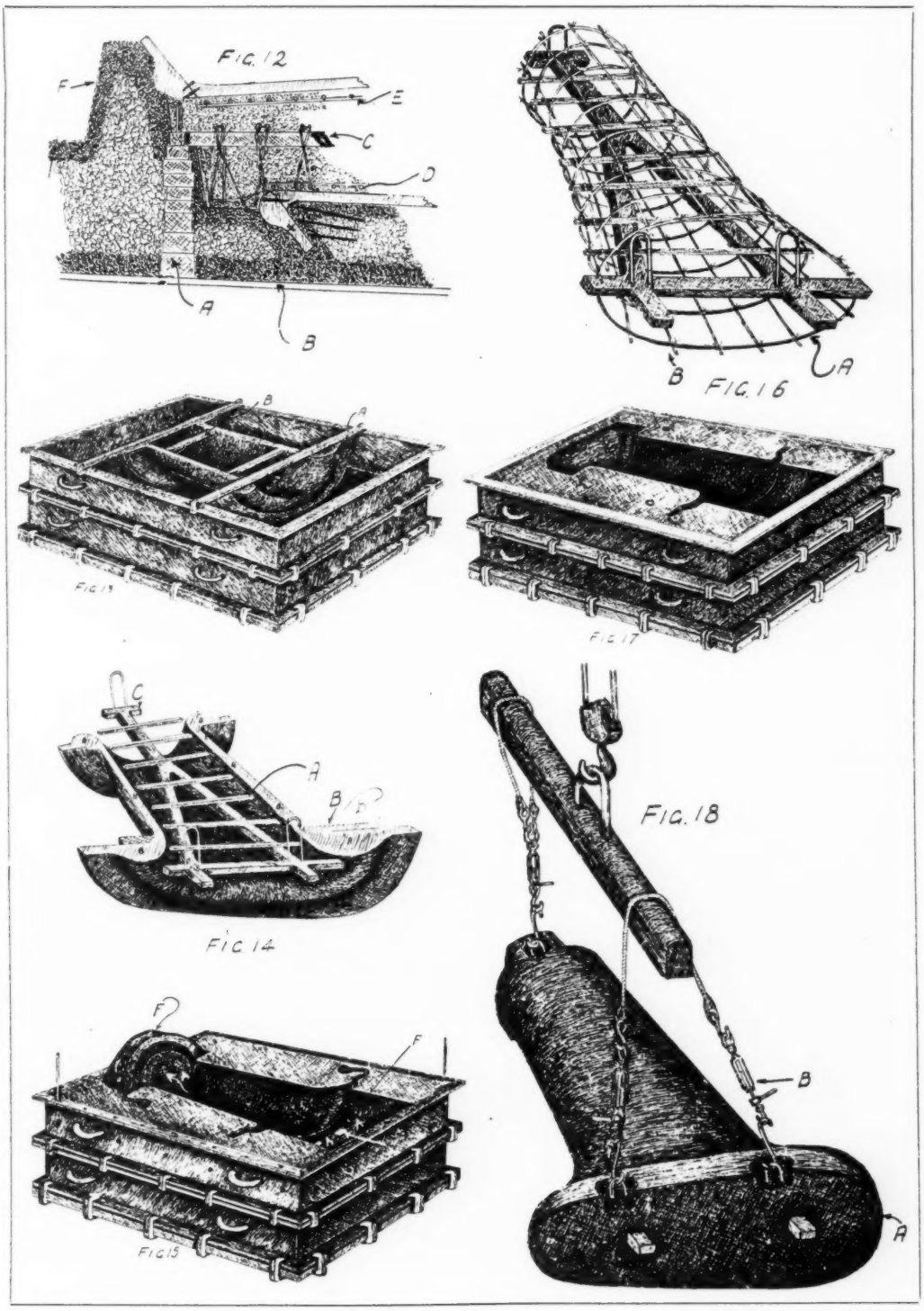
This pattern plate consists of a perforated steel plate, the dowel holes of which have been drilled at determined equidistances, and stamped with reference numbers, as shown at Fig. 1, and A, Fig. 2; B and C, Fig. 2, show the dowel and dowel plate.

However, it is generally understood, that to obtain the best possible results, close co-operation must prevail between the foundry and pattern shop. Therefore, the latter are supplied with a wood duplicate of the pattern plate. This enables the pattern-maker to place the dowel arrangement in the desired position, after which the reference numbers are stamped on to the pattern for the guidance of the moulding machine operator, as shown at Fig. 3.

Fig. 4 illustrates a sole-plate casting made by this method. The main portion, A, being placed at dowel numbers 59 and 229, to constitute the bottom half of the mould, after which, this is removed from the plate and replaced by the

portion B, or dowel number 59, to complete the mould.

Fig. 5 shows how the plate is utilised for making different types of moulds together. A, B, and C, as will be noticed, are half patterns. These are placed at dowel numbers A 57 and 65, B 104 and 177, C 118 and 181. After ramming the bottom part of the mould these patterns are replaced in their respective positions to complete the moulds, "D" "E" "F" on dowel numbers 225, 230 and 235, are taken away and replaced by the bosses "G" at the same numbers.



A Moulding Box Locating Arrangement.

Sometimes in carrying out machine- and plate-moulding operations, losses occur through faulty locating pins, etc., causing overlapping at the line of juncture on the casting. One method of dealing effectively with this problem is to drill suitable holes at the corner of the boxes, as shown at Figs. 6 and 7, a jig being used for this operation to ensure their coincidence. Case-hardened dowel pins are then fitted in alternate holes, as at corner sections, Fig. 8, A and B. It will be readily seen, that when the top-half box is turned over and placed on the bottom half, the whole four of the dowels come into action, thereby reducing to a minimum any movement of the boxes. Fig. 9 shows a type of guide pin which is used to guide the dowels into position, as at Fig. 10. After locating, these pins are removed, then replaced by cotter pins or cramps.

A Lifting Device for Cores and Drawbacks.

Fig. 11 illustrates a steel hawse-pipe casting, of which it is proposed briefly to describe the moulding operations. A suitable box in which to form the bottom half of the mould is first chosen.

The pattern is then tried in to mark off its desired position. This done, a number of pieces of iron packing "H," Figs. 12 and 15, are placed on the bottom plate "B," Fig. 12. These support the core bar "C," Figs. 12 and 14, after which floor sand is rammed to a suitable height, and the bottom half of the pattern again located. This is now fastened down and stayed, as shown at "A" and "B," Fig. 13, to prevent same from being distorted during the ramming process. The ramming of the bottom half completed, the joints are made as shown at "F," Figs. 12 and 15, after which the making of the core is commenced by first placing into position on the facing sand the half-hoops and straight rods "B," Fig. 16, and "D" and "E," Fig. 12. These hoops are divided, to facilitate the ramming operations and also allow the core to be placed into position on the bearings previously mentioned.

After locating the small bars "H," Fig. 14, are placed as shown. These supply the means by which the gaggers and hoops are suspended, and help to carry the hanging weight of sand, etc., below the core-bar. The ramming of the core is now proceeded with to a suitable height, when the top half-hoops are wired to those below.

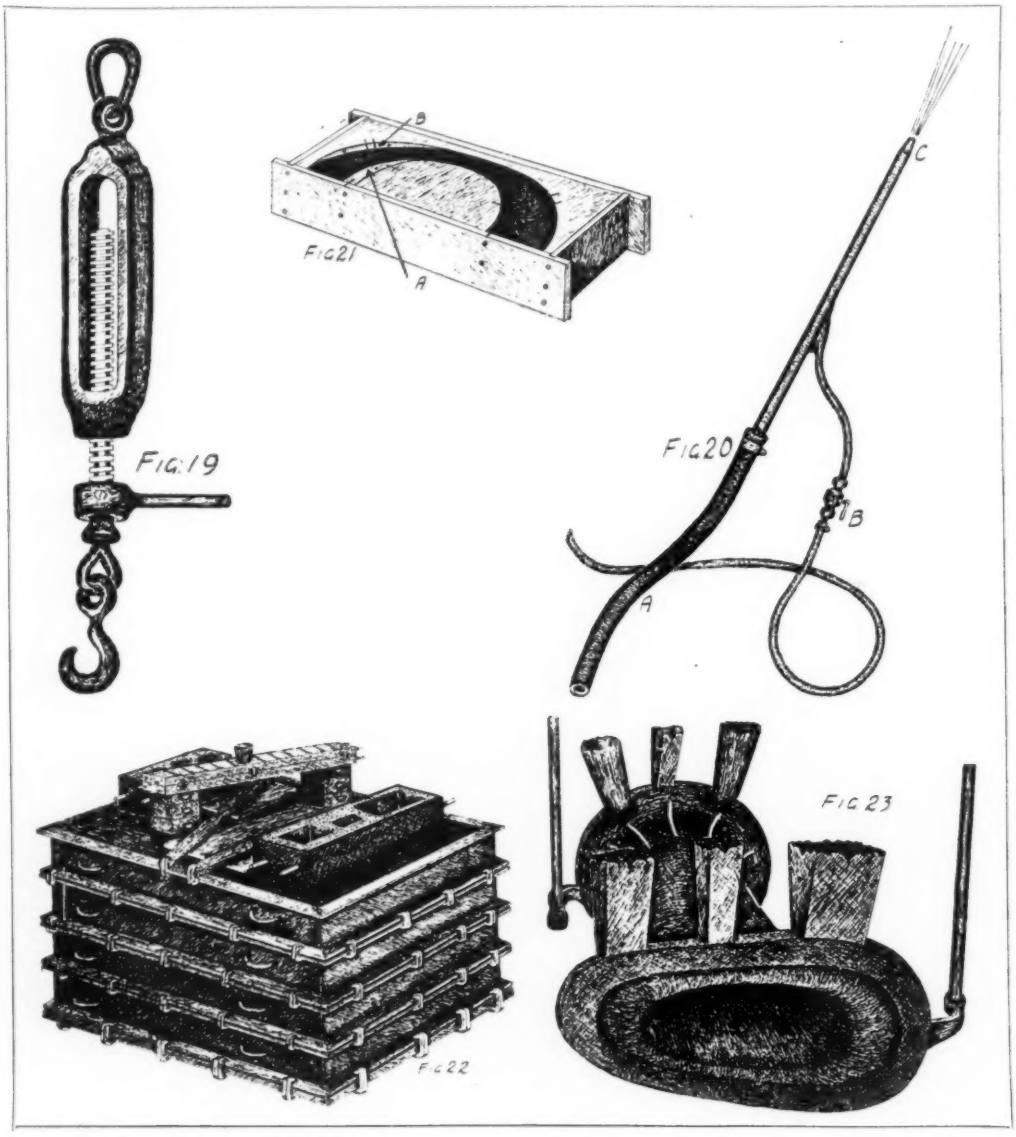
This completes the cage as at Fig. 16. The joint A at the large end of the core, Fig. 18, is then made, after which the top half-box is located and the ramming up, etc., of same completed in the customary way. This accomplished, the top portion of the mould is lifted off as at Fig. 17, and the core is withdrawn from the mould by means of a beam, wire, slings, and the adjustable hooks, as shown at "B," Figs. 18 and 19. These hooks can be regulated so as to give a true balance to the object lifted, thus mitigating greatly against undue strain being placed on the core by faulty slinging.

A Foundry Paint-Spray.

It will be readily appreciated that paint application, by the swab or brush method, is a somewhat dirty proceeding, especially to the underside of a large core or drawback. Therefore, a means has been devised by which the painting operations on these are carried out with a compressed air and spray contrivance, Fig. 20.

To operate this device, the tube "A" is placed into a container of prepared paint, and the compressed air at "B" turned on. This syphons the paint and ejects same through the nozzle "C." This arrangement is not only cleaner, but more economical than the old method. All the different portions of the mould having been finished off, the lightening cores are placed in their prints "B," Fig. 14. In making these cores only one-half core-box is necessary, one portion of which is made from the box, as shown at Fig. 21. The loose pieces "H" and "B" are removed, and similar reverse pieces placed in the opposite positions to complete the core. All that now remains is to stove in the usual way.

Fig. 22 shows the mould reassembled with the extra head allowances, H, and the runner arrangement ready for casting, and Fig. 23 shows the casting before the removal of runners, etc.



Carbon Steel and Carbon Vanadium Steel by the Converter Process.*

By S. R. Robinson,† Bay City, Michigan.

Steel made by the converter process has become very scarce in this country in recent years, having been displaced by electric steel, both acid and basic, in many places.

The Industrial Works, Bay City, Michigan, maintain a foundry for the production of the castings entering into their product, locomotive cranes. As this company is one of a very few still using the converter process in the production of steel for their steel castings, it is hoped that an account of the practice pursued will be of interest.

Cast Carbon Steel Practice.

It has been claimed that electric steel is superior to converter steel, due to fewer oxides and non-metallic inclusions in electric steel. If the superiority of electric steel is due to this it would seem that tests on "as cast" unannealed converter steel would show low results on elongation and reduction of area on tensile tests.

The Industrial Works specification on un-annealed cast carbon steel calls for the following minimum physical properties:—

Tensile strength	...	26.7 tons per sq. in.
Yield point ...	...	13.4 tons per sq. in.
Elongation in 2 in.	...	15 per cent.
Reduction of area	...	18 per cent.

Test Results.

A separate test bar is poured from every other blow of steel, and the average physical properties obtained on all test bars poured and tested in the "as cast" condition in April and May, 1925, are as given in Table I.

Melting and Refining Equipment.

A 60-in. dia. cupola inside the lining is used. The charge consists of 70 per cent. steel scrap and 30 per cent. low phosphorus pig-iron, which is melted with 320 lbs. of coke to the ton of metal charged. A 3-ton side blow converter is used.

Table I.—*Average Physical Properties for Test Bars "as cast" April and May*, 1925.

	April	May
Tensile strength, tons per sq. in. ...	31.2	30.9
Yield point, tons per sq. in. ...	17.4	17.5
Elongation per cent. in 2 in. ...	19.5	22.5
Reduction of area per cent. ...	24.5	27.3
Number of blows	77	105

Only one blow in April went as low as 15 per cent. elongation.
Only one blow in May went as low as 17 per cent. elongation.
Total metal charged in April 490,000 lbs.
Total metal charged in May 713,000 lbs.

Sulphur.

For the removal of sulphur the cupola metal is treated in the ladle with alkali compound. By the use of 35 lbs. of granular soda ash to a 3-ton blow the sulphur is kept below 0.07 per cent. On particular work where a lower sulphur is desired we use 50 lbs. of an alkali compound containing sodium carbonate and sodium hydroxide. By this practice the sulphur is kept below 0.05 per cent.

All are familiar with the controversy over high sulphur in converter steel in the past. On one side were the shop men who claimed that high sulphur was harmful, and on the other side were the chemists and metallurgists who claimed that good steel castings could be made with high sulphur metal. This latter view was based to a great extent on the results of physical tests made on annealed test coupons. The writer being in this last group admits that he held to this latter view, with limitations, up until the introduction of the alkali compound. Since using this material and noting its beneficial effect on the castings themselves, the freedom from cracking being the main benefit, and leaving out any reference to the physical properties on test coupons, the writer is now convinced that it is necessary to have low sulphur to make good steel castings. He is convinced that this element in amounts above 0.05 per cent. does have a harmful effect, and if it can be kept down to 0.03 per cent. the steel will be still better. The phosphorus is kept below 0.05 per cent. at all times.

Ferro-Alloys.

Twenty-six pounds of 80 per cent. ferro-manganese to the ton of steel poured is used, adding it to the converter. Twelve pounds of 50 per cent. ferro-silicon per ton of steel poured is used, adding it to the ladle.

Losses.

Losses are estimated as follows:—Cupola loss, 3 per cent.; converter loss, 15 per cent.

Cost.

The cost of molten metal in April and May, 1925, was less than 0.875d. per lb.

Chemical Analysis.

The chemical analysis on cast carbon steel is kept within the following limits:—C, 0.17 to 0.22; Mn, 0.75 to 1.00; Si, 0.30 to 0.40; P, under 0.05; and S, always under 0.07 per cent. and under 0.05 per cent. when desired.

Manganese.

The manganese is kept high—that is, above 0.75 per cent.—and the carbon low. The tensile strength is obtained with the manganese and not with the carbon. In working to a physical specification on "as cast," un-annealed cast steel, it is possible to obtain the tensile strength with carbon at 0.25 per cent. and manganese at 0.60 per cent., but it is much more difficult to obtain the elongation with this composition than with the low carbon and the high manganese. Much more trouble has been experienced with cracking, when using higher carbon and low manganese than is the case with the low carbon and high manganese. An intensive study of the effect of high manganese on low carbon cast steel would be a very profitable field of investigation.

Just recently, on a difficult casting, the manganese was run up to 1.25 per cent. with carbon 0.21 per cent. with a perfect casting as a result. The physical properties of this steel "as cast" were as follows:—Tensile strength, 37.0 tons per sq. in.; yield point, 20.9 tons per sq. in.; elongation on 2 in., 20.5 per cent.; and reduction of area, 34.1 per cent.

Aluminium.

Very little aluminium is used at any time. Aluminium is fatal to the elongation on steel tested in the "as cast" or un-annealed condition. No other deoxidisers of any kind are used.

Non-Metallic Inclusions.

Demanding good physical properties of cast steel in the "as cast" condition, and by that is meant good elongation and reduction of area as well as moderately high tensile strength, brings out two main points, namely, it assures the steel maker that his steel is free from non-metallic inclusions and slag. He does not have to depend on annealing to cover up any defects, but rather he can carry on his heat treatment so that he will know for a certainty that his various treatments will give him the desired results. Further, steel which has good "as cast" properties behaves differently in the mould—it has less tendency to crack and the piping is not so great.

Heat Treatment.

The regular annealing treatment given carbon steel is as follows:—

Heat Treatment F: Heat to 880 deg. C. and hold at this temperature 1 hr. per in. of section.

* A Paper read before the Syracuse Meeting of the American Foundrymen's Association.

† Metallurgist, Industrial Works.

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Cool in furnace to 730 deg. C. Remove from furnace and cool in air.

A much more severe heat treatment for such castings as cast tooth gears for extra heavy duty is as follows:—

Heat Treatment R: Heat to 880 deg. C. and hold at this temperature 1 hr. per in. of section. Quench in water and remove before cold. Reheat to 510 deg. C. for 1½ hours. Cool in furnace.

Table II.—*Comparison of Properties Obtained with Heat Treatments F and R.*

	As cast.	Heat treatment F.	Heat treatment R.
Tensile strength, lbs. per sq. in.	30.7	32.1	37.9
Yield point, lbs. per sq. in. ..	17.2	18.7	22.3
Elongation in 2 in. per cent.	19.0	31.0	18.0
Reduction of area, per cent.	24.0	46.0	40.0

The above heat treatments will give the physical properties to attached test specimens as shown in Table II.

Carbon-Vanadium Steel Practce..

The cupola charge for vanadium steel consists of 50 per cent. low phosphorus pig-iron and 50 per cent. purchased low-phosphorus steel scrap. All vanadium steel is treated with alkali compound, using 50 lbs. to the 3-ton blow, as explained under carbon steel. The ferro-manganese is added in the converter and the ferro-vanadium and ferro-silicon in the ladle.

The chemical analysis is kept within the following limits:—Carbon, 0.35 to 0.40; manganese, 1.00 to 1.10; phosphorus and sulphur, below 0.05; silicon, 0.30 to 0.40; and vanadium, 0.18 per cent.

All vanadium steel is heat treated as follows:—

Regular Vanadium Heat Treatment: Heat at the rate of 400 deg. an hour to 900 deg. C., and hold at this temperature 1 hr. per in. of section. Remove charge from furnace and cool in air until black. Reheat to 650 deg. C., and hold at this temperature 1 hr. per in. of section. Cool in furnace.

Special Vanadium Heat Treatment: Heat at the rate of 205 deg. C. an hour to 900 deg. C. and hold at this temrepature 1 hr. per in. of section. Remove charge from furnace and quench in oil. Remove from oil before cold. Reheat to 510 deg. C. and hold at this temperature 1 hr. per in. of section. Cool in furnace.

The above heat treatments will give the following physical properties to attached test specimens as shown in Table III.

Table III.—*Comparison of Properties obtained with Regular and Special Vanadium Steel Heat Treatments.*

	Regular Vanadium heat treatment.	Special Vanadium heat treatment.
Tensile strength, tons per sq. in...	42.8	55.7
Yield point, tons per sq. in. ..	29.0	40.1
Elongation in 2 in., per cent. ..	22	18
Reduction of area, per cent. ..	45	35

Skim Gates.

The foundry produces a large number of jack beams or out-riggers for wrecking cranes which are poured with carbon vanadium steel. Up until approximately one year ago the practice in regard to the heat treatment of these castings was to give them the first part of the treament, which consists of an air quench from 900 deg. C. After this they were sent to the machine shop and rough machined on the top and bottom surfaces. If any welding was necessary it was done at this time. They were then returned to the foundry and given the second part of the heat treatment, which consists of a heating to 650 deg. C., with furnace cooling. They were then returned to the machine shop for final machining. It frequently happened that these castings required welding on account of dirt and slag on the cope surface. As this welding, re-handling and re-machining was quite expensive, the foundry organisation set to work to make them with a clean cope surface. If they could be made free from dirt and slag, they could be given the full heat treatment in the foundry at one time, and then finished machined with one set up on the planer in the machine shop. These castings are quite heavy for a converter shop, weighing up to 1.5 lbs., and having a cope surface of 12 in. by 120 in., or 1,440 sq. in.

All the converter steel is poured over the lip, using a teapot ladle. Even with the utmost care some slag will enter the mould when pouring over the lip, and a way was found to prevent this slag from entering the mould. All have heard of skim gates for cast iron, but to the author's knowledge no successful skim gate for steel has been used in regular practice until the introduction of the following device:—This device was originated by J. H. Crawley, the foundry superintendent. The device consists of a basin made in a core with small holes through which the metal flows into a second basin, and the metal then rises to a central opening, from which it flows into the regular gate of the mould. This device will positively prevent the passage of any slag or dirt from the ladle into the mould. It has been used with much success on all jack beam moulds for the past year. When using it the jack beams are given the full heat treatment before leaving the foundry, and are finished machined without any welding. This skim gate is used in regular practice in the foundry on any important work in iron, brass, and steel, and it is very successful.

Catalogues Received.

Cast-Iron Pipes.—The October monthly stock list of cast-iron pipes issued by the Staveley Coal & Iron Company, Limited, Chesterfield, is now available.

Electro-Mechanical Hammer.—The Kango Company, of 78, Petty France, London, S.W.1, have sent us a new pamphlet dealing with the Kango Hammer. This was recently fully described in these columns. It is a twelve-page pamphlet printed on art paper and effectually covers the ground where this useful tool can be employed. We understand it is available for all foundrymen on application.

Steel Barrows.—We have received from the Constructional Engineering Company, Limited, of Titan Works, Birmingham, list No. 138, which illustrates and describes a series of steel barrows known as the Titan, which they manufacture.

To the average engineer it will come as a surprise to find the very large trade which is developing in steel barrows. Apart from their use in foundries for handling the coke and pig-iron, they are used in the greatest numbers in gas works, by contractors, and for railway and public works; but of late years, in addition, they are coming into extensive use for agricultural and domestic work in connecton with the garden and stable. Their growing popularity is explained by the fact that prices for the steel construction have been brought down to the level of—or even slightly below—wooden barrows of equivalent capacity, while the steel barrow offers advantages over its wooden prototype in that its life is much longer, and it is much easier to handle on account of the shape which can be given to the handles, these being bent upwards to a convenient height, and obviating the constant stoop which is necessary with the straight "trams" of a wooden barrow.

In regard to cost, it is now possible to purchase a steel barrow having a capacity of 3 cub. ft. at about 32s., which compares favourably with the price of a light wooden barrow of similar capacity, while there are few users with any experience of the damage which can be done to the wooden barrow by constant use of fork or shovel who would not be prepared to pay even a considerably increased price for a steel body on account of its greater durability.

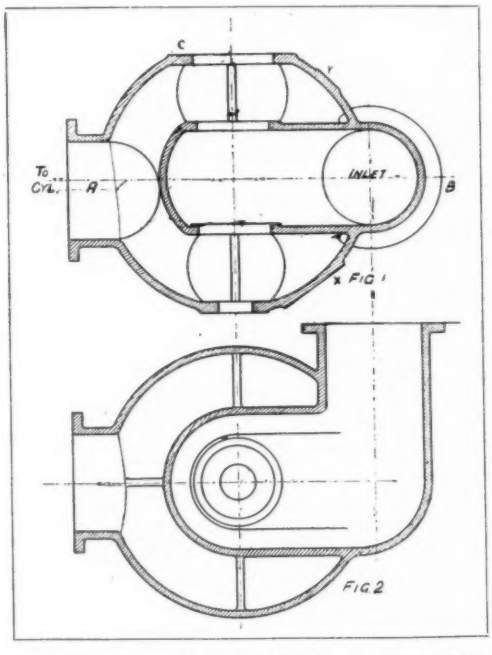
Export markets yearly absorb thousands of such steel barrows, and for shipment the bodies are taken down and nested one inside the other, the tubular framework bundled, and the steel wheels wired together so as to economise space and make an economical shipment.

Regulating Valves.

By Shaw and Edgar.

The main valve for regulating the steam to the cylinder of a reciprocating engine usually has a spherical body for greater strength, and as these valves are large a type known as a balanced valve is invariably used. A balanced valve actually consists of two valves on the same spindle, the pressure of steam on one being balanced by the pressure under the other. The pressure on an ordinary valve of about 16 in. would be approximately 20 tons, which, as can be readily understood, would create difficulty in manipulation.

The bodies or chests for large regulating valves used to be made of cast iron, and in some cases cast iron is still used, but more often steel castings are employed, and this has a bearing on the pattern and corebox work. Figs. 1 and 2 illustrate a very common type of regulating valve. It



will be observed that the branch to the cylinder is not on the same centre as the valve chest proper. It is necessary to "hand" a valve of this type, that is, the branches must usually be altered for a port casting if the pattern is made for a valve for the starboard side of the ship. In the valve shown reversing from starboard to port is very easily done, as only the inlet valve requires to be reversed. The facings remaining in the same position and also the outlet valve to the cylinder. It is sometimes possible to alter the valve by simply turning it upside down, but in the valve shown this would involve much more work than reversing the inlet branch. In very rare cases does the same casting do for either port or starboard side.

It may be well before describing the pattern-making and corebox construction to deal briefly with the usual method of moulding them. The pattern is jointed along the same plane as the mould, that is through the line centre AB. The face C is cast down, the only reason for doing so, however, is that a larger print bearance is provided. In some pattern shops the internal chamber with the valve seats is made as a shell pattern inside the corebox, but this results in an exceedingly fragile job, and it is doubtful if there is any gain in time in the patternshop; there is certainly none in the foundry. The most practical method is to make a large corebox for the valve chest and fit a block pattern in this. which is in turn cored, and that is the method we propose to describe here. It will be obvious that considerable care has to be taken in making the coreboxes, especially the inlet branch core, in order to obtain the correct metal thicknesses. Figs. 3 and 4 are two views of a finished pattern. It will be observed that the inlet branch is made quite separately from the main chest, so that it can be reversed as indicated by the dotted lines. The outlet branch is made in two exact halves and fitted the necessary distance from the joint of the pattern body.

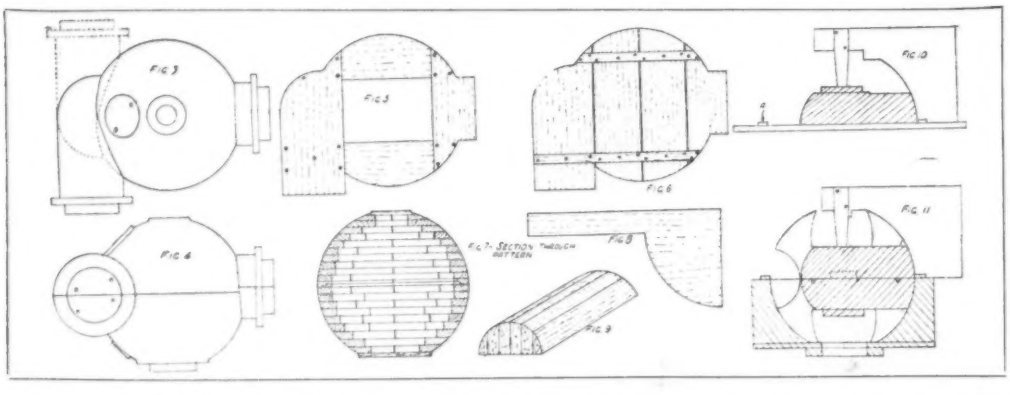
It is always advisable when making a large pattern to construct joint plates to which not only the main body but the branches can be screwed if it is possible. At Fig. 5 is shown a joint frame that might be used for a regulating valve in which both inlet and outlet branches were on the same plane and did not require to be reversed. In the case of the valve being considered the outlet branch would have to be made quite separately, but the inlet branch could be fastened to the joint plates. In reversing the work the plates would be unscrewed and the one on the top half of the pattern changed to the bottom and *vice versa*. The gain in constructing the pattern in this way is that a very rigid job is obtained, and the position of the inlet branch is likely to be more accurate than when it is simply butt-jointed against the pattern body. As an alternative to a frame, a plate similar to Fig. 6 may be made with cross battens preferably made of hard wood and inset to half the thickness of the plate. If such a plate is open jointed it should retain its shape as satisfactorily as a half-lapped frame, and there is certainly the added advantage that centre lines can be drawn right across it.

In regard to the spherical body, this is best made by the segmental method. In the illustration Fig. 6 it will be observed that segments take the place of the joint plates and the inlet branch has consequently to be made entirely separate from the spherical body. There is one advantage in this construction that a spigot joint can be turned and the whole pattern is an accurate sphere. The top half of such a pattern is prevented from revolving on the spigot by the insertion of one dowel pin in the joint. It is advisable with a large spherical pattern such as this that the top plates of each half should be made of hardwood, because the pattern is not easily handled and sharp corners are apt to get knocked off in the foundry. When joint plates are used the two halves are, of course, turned as quite separate parts to the same template and screwed to the joint plates, which is worked off by the aid of a template. It may be well to mention that joint plates should be at least 1½ in. thick. In regard to the segments for the sphere, these should be at least 2 in. and for preference 2½ in. wide when turned, and it is inadvisable to use timber more than 1 in. thick. We have seen patterns of this description made skeleton fashion, but there is really no gain in doing so. One can understand a skeleton pattern for a regulating valve being made in a small repair shop when there is no lathe of sufficient capacity to turn the job, but not otherwise.

The outlet branch does not present any difficulty. Each half may be made in three separate pieces, the body, the flange and the print. In regard to fitting the branch on the body the shape can be drawn on the joint, and if the main body is stitched to a level board and a parallel thickness placed on this board on which the branch can rest, fitting is quite easy. A fitting line can be drawn round the diameter if it is thought advisable, or a template may be used similar to Fig. 8. If the sphere has been accurately turned it should be possible to screw a branch shaped with a template to it without further fitting. It is in nearly all cases labour-saving to use a template when fitting branches. The inlet branch involves more work and must be built of several thicknesses of timber. Jointing the timber as shown

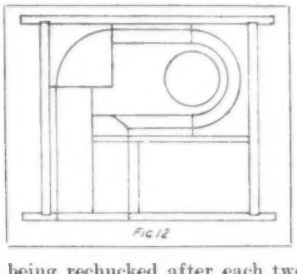
at Fig. 9 is a very satisfactory form of construction for a large branch. This branch may be turned and the end shaped afterwards, or it may be planed to a diameter at the bench. The fitting shape can be marked on the joint and a template used as in the case of the other branch. If the branch is fitted on a joint plate there is no difficulty in locating it and less need for great accuracy in fitting it to the body. When it is in two exact halves and butt-jointed to the body it must be a very exact fit, and the spherical halves also must be identical or difficulties will arise when the pattern is reversed. The two facings X and Y, Fig. 1, may involve much or little labour according to the method employed in making them. They ought to be paired to a diameter first, centre lines having been marked on the faces. A centre line should be marked on the main body by the aid of a template from the top face to the joint, and trammels can then be used to assist in locating the facings accurately.

There are several ways in which the cores for a regulating valve may be made. Fig. 10 shows the simplest way from the patternmaker's point of view, but it is not customary to adopt this method for steel valves. It may be well to describe it, however, before discussing a more satisfactory



method. A plate is first made about 1¼ in. thick, and on this plate a block pattern is fitted for the internal part of the valve which carries the seats. A pin board is then made which is guided by a thin segment A, Fig. 10.

Fig. 11 shows a satisfactory corebox which is built up of segments in a similar way to the pattern. Circular coreboxes of this kind sometimes cause difficulty in turning. A slight saving in timber may be made by keeping all the layers of segments of approximately parallel width, but it is really more satisfactory to build as shown in the illustration. It simplifies turning the corebox considerably, especially if there is not a suitable tool rest if the turning is done in sections,



the work being rechucked after each two or three courses of segments have been built. It is very rare that a full corebox is made for a regulating valve, and it is not necessary. The top core is built on the bottom core, a board being used as shown in Fig. 11. There are actually three cores made for the valve, the bottom main core, the centre core, and the top main core. Although the top main core is swept on the corebox, it is a distinct and separate core, it being necessary that it should be so because of the setting of the centre core. It will be noticed that ribs connect the inner and outer walls of metal, but these are not used as supports for the block, which is fitted into the bottom corebox. This block is kept in position while the bottom core is being rammed by means of a joint batten, which is screwed and dowelled to the corebox so that it can be removed and replaced easily. It is, as a matter of fact, removed after the bottom core has been rammed in order that the top part of the block can be placed in position and the pin board used to sweep the top cores. It will be noticed that there is no top print on the job. It only remains now to make a core box for the space between the valve seat and the inlet branch. This may be built up skeleton fashion, an outer frame being first constructed in which section pieces are fitted. It is, of course, necessary to make a full core box, or at least advisable to do so, and it is doubtful if any advantage is gained by making it a skeleton core box. It is not a very big job to build shaped solid blocks into a frame box with a bottom, as shown in Fig. 12.

Double regulating valves are common for turbine work, and sometimes these are very interesting and rather difficult jobs, but generally speaking the tendency is towards simplicity of design, and there is not really much if any greater difficulty in making the average double valve than single valve. When the main body is of parallel diameter between the two valve centres it is best constructed of staves built on suitable grounds, the semi-spherical ends being segmentally built, both centre staved portions and segmental ends are held together by pocket screws and joint plates. Sometimes instead of the distance between the valves being of parallel diameter, double regulating valves are really two spheres with a joint piece which is of much smaller diameter between them. The best method of construction in such a case is to build two segmental spheres, screw them to a joint plate, and fit the distance piece between.

For double regulating valves especially there is great diversity of design, and some ingenuity is frequently necessary in order that branches may mould easily, while coring presents difficulties. On the whole, however, the methods employed in patternshop and foundry in making a double regulating valve are not greatly different from those used in making a simple single valve such as that we have described.

(To be continued.)

Marshall, Sons & Company, Limited, Britannia Iron Works, Gainsborough, inform us that they have recently secured one of the largest contracts for steam road rollers placed since the war. The contract is for supplying the Greek Government with 100 engines of the "Marshall" Class "S" series.

The first dispute that the blastfurnacemen have had since the sliding scale method of regulating wages, according to the selling price of West Coast hematite pig-iron was adopted in 1882, occurred last week. According to the sliding scale a reduction of 5½ per cent. is due on the men's wages. The 1,000 men employed at the United Steel Companies' five furnaces that are at present in blast at Workington have protested against this reduction and threatened to hand in their notices. Mass meetings of the members of the various lodges of blastfurnacemen have been held, when it was decided to defer the notices to cease work on October 2 in order that the National Executive may have an opportunity to examine the case in detail.

Lifting Magnets for Handling Pigs and Castings.

By C. H. S. Tupholme.

It is only within the last few years that the lifting magnet has come to be looked upon as a valuable auxiliary for the handling of rough pigs in quantity, heavy castings, scrap, and similar materials. This somewhat belated recognition of what has proved to be a great labour-saving device cannot be entirely attributed to a lack of appreciation by prospective users, but also to a well-founded belief that the earlier types of magnet were to a large extent experimental. The earlier types of magnet were heavy, inefficient as far as current consumption was concerned, and their cost was almost prohibitive, while the modern magnet will give about double the lifting capacity with half the weight.

The lifting magnet is undoubtedly most useful in the works when it is possible to handle it in

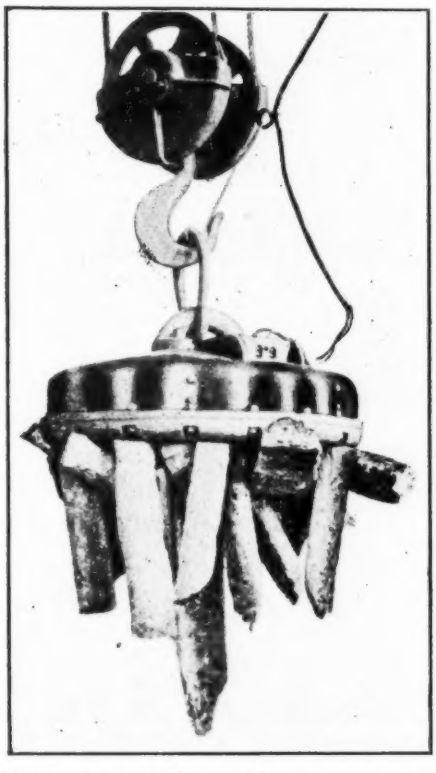


FIG. 1.—LIFTING MAGNET HANDLING PIG-IRON.

connection with a locomotive crane, if necessary in the open air and in all kinds of weather. In these circumstances the magnet must be watertight, submersible and mechanically robust, because it has to work quickly, and when coming violently into contact with a pile of pigs or scrap, anything other than the most rugged article would soon be damaged. In addition, the magnet must be easily disconnected, so that if necessary the crane could be used for other purposes, though, for the sake of economy, it is far better if possible to reserve a crane to operate in conjunction with the magnet.

It should be possible to place a lifting magnet in the charge of an inexperienced man, and with very few instructions enable him to operate it efficiently. For the best results, the magnet should work uninterruptedly throughout the day, and obtain full field before coming into contact with its load so that a full lift is obtained immediately. Fig. 1 shows a perfect lift.

When releasing the load means must be provided for de-magnetising the magnet quickly, so that no time is lost while waiting for the contents to drop off. An experienced craneman used to operating with one of these magnets, unloading a ship or trucks on the bonus system, works his crane on the swing, *i.e.*, he runs the crane round at a high speed and stops quickly, and, when the load and magnet on the end of the crane chain has swung to its maximum, he de-energises the magnet and flings the load to its destination, thus saving the time necessary to travel this extra distance. From this it will be seen that quick de-energising is as important as quick energising, and also that the magnet must be suitable for rough usage.

To meet these requirements, a special type of controller has been evolved after considerable experimenting. In this controller, which is of the Igranic type, the magnet circuit is made through six pairs of contacts in series. The discharge resistance is connected across the magnet coil just before breaking, but in addition there is a reverse position to the controller. When the drum is thrown into this position, the magnet coil is reversed and thrown across the lines in series with a resistance having such a value that the field of the magnet is de-energised at once, and any residual magnetism in the material is swamped out at once. This gives the desired effect, and with the aid of this type of controller much better results can be obtained. Blowouts are also installed to make good commutation.

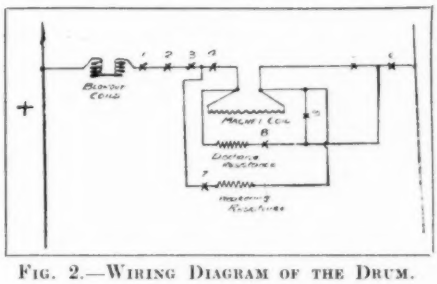


FIG. 2.—WIRING DIAGRAM OF THE DRUM.

Fig. 2 shows the diagram of the drum. Circuit is made from the positive line through blowout coils and breaks 1, 2, 3, 4 through the magnet coil in the direction of the arrow 1 through breaks 5 and 6 to the negative line. For discharging the coil when coming from the lifting position the switches 8 and 9 close, and switches 1, 2, 3, 4, 5, 6 open. For reversing the magnet through predetermined resistance, switches 1, 2 and 3 close, 4 remains open, switch 7 closes, leading the current to the opposite side of the magnet through the discharge resistance to switches 8 and 6, which are closed to the negative line. For discharging, all switches except 8 open and 9 closes.

The first question most frequently asked is, How much will the magnet lift in comparison with its weight? The answer depends upon the nature of the material to be handled, because the first layer has to be entirely saturated before another layer can be picked up, though the type of magnet illustrated is usually capable of lifting from ten to twelve times its own weight. In this connection the permeability curves given in Fig. 3 are of interest.

The ultimate lifting capacity of a magnet when handling a piece of solid steel with a machined surface is determined by the cross-sectional area of the inner pole and by the magnetic permeability of the material used in the construction of the magnet body. From experiments conducted with magnets handling sand-cast pig-iron or heavy scrap, it seems that the lifting capacity of a circular magnet is fixed by the bottom area of the magnet itself.

It is possible to obtain deeper penetration with larger diameter magnets than with small, for the reason that the wider spread of the poles tends to produce a deeper penetration of the magnetic lines, and also the larger central core used in large

diameter magnets is capable of carrying a sufficient number of lines to more than saturate the layer of material immediately adjacent to the pole face. However, from this it must not be understood that the smaller type of magnet will not penetrate a second or third layer, but that the grade of material being lifted decides the lift.

An Unconsidered Saving.

Where a considerable saving is found in the use of magnets is in lifting pigs. When pigs are dropped into trucks chips are knocked off them, and when the trucks are unloaded by manual labour these chips are left behind, whereas the magnet lifts pigs and chips together. In many cases as much as 700 lbs. of iron per truck has been saved in this way.

Handling Plates.

The construction of magnets for handling plates has presented a serious problem, because circular magnets are not ideal for this purpose for the reason that the natural flexure of the lifted plate tends to tear the plate away from the magnet poles. A half-inch plate 10 ft. or 15 ft. long, for

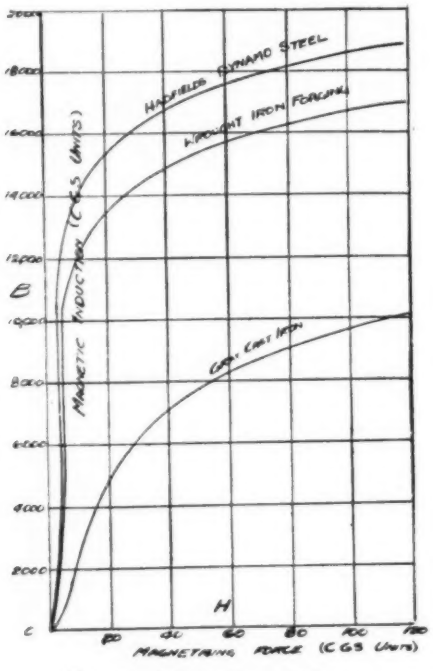


Fig. 3.—Permeability Curves.

example, when attracted by a circular magnet, will droop at both ends to such an extent that the plate will only make contact with the magnetic pole along one line, hence it will not be attracted with sufficient strength to permit its safe transportation.

This problem has, however, been adequately solved by the design of a rectangular lifting magnet. The advantages of the rectangular lifting magnet for this class of work is maximum lifting capacity for a given weight of magnet, resulting in economy in the price of the magnet, crane equipment and current consumption.

In one large works the unloading of sheet steel for laminations from trucks to storage was formerly done with slings, necessitating the employment of four labourers. Two rectangular magnets of the Igranic type were then installed, and the same work is now done by one man in about one-sixth the time. In the same works a rectangular magnet is used for transporting heavy ship plates to and from the punching machines. Several works employ these magnets for unloading pipe, and it is an interesting fact that the crane operator usually becomes sufficiently adept with the special type of magnet controller employed to be able to limit the load by first lifting a full load and then dropping as many pieces as desired to retain the required amount. In other cases these magnets are used for handling cold-rolled steel in coils, as well as billets, slabs, ingots, and other heavy rectangular sections.

When the thickness of the material is 2 in. or greater, all four sizes of the Igranic rectangular magnet will have a lifting capacity of 450 lbs. per lineal inch of magnet in contact with the load. On round stock 2 in. and over in diameter the magnet has a lifting capacity of approximately 260 lbs. per in. diameter; for instance, a magnet 20 in. long will lift five 4-in. pieces weighing 1,040 lbs. each. For standard length pipe two magnets on a spreader bar are used. For lifting plates as well as other long shapes, the magnets are placed with their long dimension at right angles to the long dimension of the plate, and the width of the plate, for the best results, should not be more than twice the length of the magnet. Two or more magnets on a spreader bar are used when the length of the plate exceeds the maximum for one magnet, and when two magnets are used they should be spaced a distance apart equal to one-half the length of the plate.

At one time it was general practice to instal with all lifting magnets a battery, so that should the power supply fail or vary any considerable amount, the battery could take up the load and so avoid an accident. This has now been done away with, and the magnets are saturated to a much greater extent, so that by working on the high part of the saturation curve a slight variation in the voltage would only cause an inappreciable amount of change in the strength of the

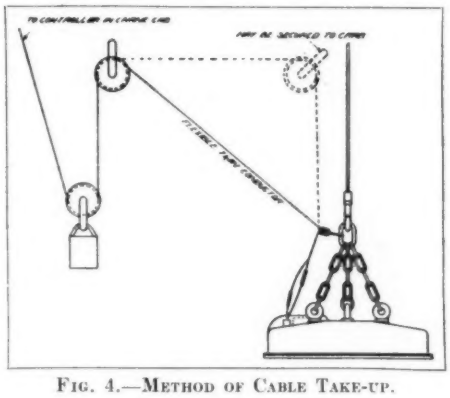


Fig. 4.—Method of Cable Take-up.

field. Instructions should, however, be given to crane men that on no account must they carry loaded magnets over the heads of men, and workmen should be forbidden to remain under cranes in operation.

It is necessary, however, to note how important it is to maintain the circuit of the magnet intact at all costs. The power to the magnet must either come from a separate generator purposely installed for the job, and for this reason it has been found that turbine sets work best, especially with locomotive cranes. As the magnet is usually employed on a crane, the connections actually going to the magnet must be flexible so as to lower or raise easily, according to the position of the magnet. This problem has been met by a neat cable take-up shown in Fig. 4.

This often consists of a 2-h.p. series-wound motor taking 2 amperes at 220 volts from the same feed wires that energise the magnet. It is an electrical axiom that the torque exerted by a motor of constant field strength will vary with the strength of the current admitted to the armature winding. This principle is utilised in the case of the cable take-up by inserting in the armature circuit of the motor a fixed resistance which limits the pull the motor can exert on the cable to a predetermined maximum, which is just sufficient to keep the cable taut at all times. Current for energising the magnet is transmitted to the cables by the collector rings on the right-hand side of the drum.

A lifting magnet may be considered as a bundle of ampere turns enclosed in a casing of magnetic material—cast iron or steel. Assuming proper design, the greater the product of turns multi-

plied by current, the greater will be the lifting capacity of the magnet, and the greater the current taken by the magnet the higher will be the efficiency, since the proportion of live load to dead weight is increased. The problem of the designer is therefore to condense the greatest number of ampere turns into the minimum space.

The size of the magnetic circuit is to a large extent governed by the overall diameter of the magnet, and, in consequence, the higher the space efficiency which it is possible to obtain, the greater will be the number of ampere turns, and the higher will be the lifting capacity of the magnet. In very small magnets the coils may be made up of circular section wire, but in the larger magnets the highest space efficiency is obtained by constructing the coil of copper strap, successive turns being insulated by asbestos ribbon. The spools on which the coils are wound are of steel and form a part of the inner pole. It adds nothing to the weight of the magnet, since by employing a spool of magnetic material it is possible to reduce correspondingly the amount of metal used in the magnet frame.

The windings of the magnet are arranged so that there is no inside lead, the connections being brought to the terminals mounted on the coil itself. The insulation between coil and magnet is micanite, and to render all troubles through earths impossible, the whole of the magnet is impregnated after the coil is assembled in its place.

It is essential that the terminals of a lifting magnet be so protected that they are able to withstand the hard knocks they usually receive in service, and it is no less essential that they be absolutely watertight, since water in the interior of the magnet will earth the coil and render the magnet useless for the time being.

Access to the under side of the magnet coil can be obtained by merely removing the manganese steel coil shield, which has holes in several of the ribs so that it can be handled easily. The upper side of the coil is readily accessible by lifting the coil out of the magnet body and removing the steel disc which forms the flange of the spool. The core of the spool to which the removable flange is attached is provided with tapped holes into which eyebolts can be screwed in lifting the coil out of the magnet frames.

Comparative Results.

Through the courtesy of one of the important iron and steel companies, the writer is able to give the summary of a report on the comparative results obtained before and after the installation of a lifting magnet.

Crane.—Overhead travelling, 7½-ton capacity, weight 58,400 lbs., span 80 ft., lift 30 ft., hoisting speed 35 ft. to 70 ft. per min., motor 30 h.p., bridge speed 300 ft. to 350 ft. per min., 20-h.p. motor, trolley speed 150 ft. to 200 ft. per min. All 220 volts D.C.

Magnet.—52-in. circular Igranic.

Runway.—220 ft. Steel in runway 107,332 lbs.

Material Handled.—Scrap iron and steel of every kind.

Before Installation of Magnet.—Forty men employed in yard; tools, forks, shovels, wheelbarrows (annual upkeep £220); capacity, 20 trucks loaded, 20 unloaded per month. Time regularly lost building runways for wheelbarrows to trucks, lowering gates of trucks; capacity of individual truck 16 tons light sheet steel scrap about limit for hand loading.

After Installation of Magnet.—Capacity of loading increased to 35 tons, due to dense loading using magnet. Saving in truck charges. No wheelbarrow runways. No dismantling of truck.

Actual Number of Trucks Handled:—

	Receipts.	Shipments.
August	25 trucks	46 trucks
September	12 ,,	40 ,,
October	17 ,,	40 ,,

Number of men reduced to 20.

Capacity of yard increased over 100 per cent.

Installation cost complete returned under 12 months.

Record Handling.—60 tons cast-iron borings in 50 minutes; 40 tons rail anchor scrap in 40 minutes. Individual pieces of scrap weighing 15 tons handled and subsequently broken with skull cracker ball.

Operating Costs.—For crane and magnet £40 per month or 23s. per day of 8 hours continuous. Rate, 1d. per kw. hour.

The photographs are reproduced by the courtesy of the Igranic Electric Company, Limited.

The Institute of British Foundrymen Branch Presidents.

Elsewhere in this issue we reproduce the portraits of some of the Branch Presidents of the Institute of British Foundrymen. Below are a few biographical notes:—

Eng. Lieut.-Commander L. Jackson (Sheffield).—Commander Jackson served his apprenticeship with Bolckow, Vaughan & Company, Limited, of Middlesbrough, and joined the Royal Navy in 1885 as an engine-room artificer. He first served in the East Indian Station, being engaged in the suppression of the slave trade until 1890. He was promoted to warrant status in 1898, and served as officer in charge of machinery in H.M.S. "Magpie." Between then and 1902 he was attached to the Cape of Good Hope Station, and took part in the Ashantee Rebellion, the Boer War, and Agaden Somali Expedition. He was promoted to commission rank in 1903, to Engineer Lieutenant in 1910, and Engineer Lieut.-Commander in 1918. In 1919 he retired from the Royal Navy and joined the firm of Messrs. Robert Hyde & Company, Limited, iron and steel founders, of Sheffield and Chesterfield, and still occupies a seat on the board of directors. The Commander also is a member of the Sheffield City Council.

Mr. H. Summersgill (West Riding of Yorkshire). Mr. Summersgill was apprenticed in Bradford, and, after serving his time, worked in the foundries of the North-East Coast and Midlands. He commenced business on his own account in 1905. His works are the Stanacre Foundry, Wapping Road, Bradford.

Mr. J. Masters (Lancashire).—Mr. Masters served his apprenticeship at Jas. Kitson & Company, of Leeds. His first position as foreman was at Goddard, Marrey & Warner, of Nottingham, but afterwards (1913) returned to the Airedale Foundry, at Leeds, as assistant foreman. In 1915 Mr. Masters was appointed foundry foreman to Jas. Carter, Limited, of Stalybridge, and after six months he was promoted to manager. This year Mr. Masters has been appointed foundry manager to A. Levick, Limited, of Shrewsbury. Joining the Institute in 1916, Mr. Masters was soon elected to the Branch Council, and this year has been elected President. His speciality has been the making of oil sand cores, and he has on several occasions lectured on this subject.

Mr. M. B. Herbst (Newcastle).—Mr. Herbst is a native of South Shields, in which town he served his apprenticeship as a marine engineer. Later he became associated with the Northern Press and Engineering Company, Limited, of South Shields, manufacturers of printing machinery, and was appointed works manager in 1895, which position he still holds. He has travelled abroad extensively in connection with the supervision and erection of machinery. He has been a member of the Institute since 1913.

Mr. G. C. Pierce (London Branch).—There are few better known foundrymen in the London area than Mr. Pierce, who has spent most of his life in this area. He joined the Institute on the formation of a branch in London, and in 1922 was elected to the Council, and this year became Branch President. Mr. Pierce is foundry foreman to Elliott Brothers, Limited, Century Works, Lewisham, electrical and mechanical engineers.

The Newcastle and District Association of Foreman Engineers and Draughtsmen spent an interesting afternoon last Saturday at the Scotswood Locomotive Works, by invitation of the directors of Sir W. G. Armstrong, Whitworth & Company. In the evening a meeting was held in the Neville Hall, Newcastle-on-Tyne, when Mr. James Spiers, of the Hoffman Bearing Company, gave a lantern lecture on "Ball and Roller Bearings in General Engineering," the President (Mr. T. Gibson) in the chair.

XUM

An Ironfoundry in Wakefield Prison.

A feature of the prison at Wakefield is that it is the only one where ironfounding forms part of the scheme of labour introduced to inaugurate an experiment in the more humane treatment of those who have "fallen by the way." The choice of Wakefield Prison for this experiment was a happy one, for whilst it is the largest prison in the kingdom, it was also the first to abolish the tread mill in favour of productive and useful labour.

The object of our representative's visit to the prison was to see the foundry. He was, however, shown over the whole of the prison by the Governor, Captain Scott, and in conversation with that essentially human Governor, our representative realised that in the conduct of Wakefield prison lies something bigger and with wider possibilities than ironfounding, something more vitally important to the community at large.

Asked to define the scheme, Captain Scott said that, briefly, Wakefield prison, now called a "training centre," was the outward expression of the intention of the authorities to bring the prison system into line with an enlightened public conscience, to move forward without reference to retributive prejudice. To Wakfield prison come prisoners under sentence of not less than six months from various other local prisons. Of course, there are the first offenders, but there are also others with previous convictions, these last being men whom the prison authorities have reason to believe may, under proper administration and control, recover character and become again useful members of society.

Judge Atherley Jones, when dealing with a case at the Old Bailey recently, remarked that the accused man had been made a criminal by the State. If it were possible to assemble such data, of course it is not, there is little doubt that in the so-called criminal world are many thousands to whom the remark of the judge would be equally applicable.

There are men who are criminal by instinct, habitual criminals if you will, just as there are habitual drunkards, men who may be regarded as having passed beyond the possibility of even partial reformation. To such men, however, our prison system has no terrors; at the worst it is nothing more than an inconvenience; morally it has no significance. They can sink no lower, and by no human power could they be raised to a higher level. But what of the others—the first offenders? They may be accidental or they may be intentional offenders, but they are not necessarily criminal by instinct, and obviously such men should be taken in hand with a view to checking the development of all criminal tendency.

With our existing prison system this is wholly impossible. Prisoners are herded together without reference to personal characteristics, or even classification in regard to the nature of offence, and the same treatment is meted out to each and everyone.

Are those conditions under which the first offender can be expected to regain his self-respect? Would not the tendency rather be to rob him of what little self-respect remained to him after his conviction, and lead him to the conclusion that he was, and must always remain, a social outcast? Having completed his term of imprisonment, such a man may easily be worse morally and intellectually than when he entered that prison, and unless he is a man of strong will power, it is small wonder that he will make little effort to regain his lost place in society, but, following the line of least resistance, may eventually find his place in the ranks of the State-made criminals.

It is quite clear that real reformation can only be brought about by the man himself; the keynote of the treatment at Wakefield is the stimulation of that something in the individual which will enable him to bring about his own reformation.

Whilst, of course, strict discipline is enforced, there is nothing in that discipline or the methods of its application which is not calculated to encourage rather than check individual intelligence and initiative and to foster self-respect. The prisoner is not a number confined to a cell in Block A, B or C; he retains his name and the various blocks of buildings are designated by names; for example, St. David, St. Patrick, etc., houses. The first offenders are housed in an entirely separate building; the cell is a room, and in that room are flowers at this time of year. The allotment gardens are, of course, worked for the benefit of the institution, but as a reward for the labours of vegetable growing the gardeners are given a small border upon which to grow flowers for themselves, a concession which needless to say is very highly appreciated.

Another feature which Captain Scott has developed to a high degree of efficiency is the self-government of the first offenders in ordinary matters. For this purpose the men are divided into groups called "crews," the "stroke" or head being a man selected on account of his fundamental character as likely to exercise good influence. The "strokes" preside at each table and take it in turn to be "orderly stroke" to supervise the issue and conduct of meals.

The method of correction for any offence against discipline is simple but very effective. The offender first comes before his "stroke," and if not amenable to his personal talk, a joint meeting of the "strokes" is called and they bring collective pressure on the offender, and this is generally found to be effective; should it not prove so, however, the report is passed on by the "strokes" as a body to the authorities.

The men are engaged upon useful work from 6 in the morning until 8 or 9 at night. Their work is in the foundry, the rope walk, at the looms, at mat-making, or in the shoemakers' shop. They work decidedly harder than was the case with the old system, but the work is of a nature more calculated to foster self-respect. Going the round of the shops, there is little to indicate that those engaged are other than ordinary workmen, and there is a remarkable absence of that "hang-dog" expression one is accustomed to associate with the denizens of houses of detention.

After the close of the working day the men have their tea; they then attend educational classes which are conducted by teachers from schools in the neighbourhood, members of the staff, and the outside public. Captain Scott, however, so far as possible, makes the men run their own affairs of leisure and, amongst other institutions, they have a debating society.

As the whole output of the workshops goes into consumption on prisons account, the foundry is a small one, finding employment for eight men who work under the direction of a skilled foreman. The major portion of the output of the foundry is in the form of gutters and spouting. The cupola, of two-tons capacity, is blown by a fan, and the charging platform is approached by a flight of steps, charges, needless to say, being carried up by hand. One end of the foundry is laid off as a machine shop, and here employment is found for two men. A separate building is now being laid off for a fitters' and engineers' shop, and in this shop also lectures will be given on technical subjects.

The Wakefield experiment will no doubt be watched with close interest by the public generally, but it will naturally be a considerable time ere the authorities can satisfy themselves from the carefully tabulated records which are being kept, that the experiment has been justified by results. Captain Scott and his staff have the good wishes of the community behind them, and the experiment will certainly not fail if persistent effort and really human sympathy can ensure success.

Contracts Open.

Hertford, October 10. — Approximately 200 lineal yards of wrought-iron fencing, for the Corporation. The Borough Surveyor, The Castle, Hertford. (Fee, £1 1s., returnable.)

Kegworth, Leics., October 16.—Providing and laying about 1,900 yards of 3-in. cast-iron water main, for the Castle Donington R.D.C. G. and F. W. Hodson, at Bank Chambers, Loughborough. (Fee, £5 5s., returnable.)

Southampton, October 16.—About 2,950 tons of cast-iron socket and spigot pipes and special castings, 9 in., 10 in. and 15 in. in dia., for the Corporation. The Water Engineer's Office, 21, Shirley Road, Southampton.

Moulding a Square-threaded Screw.

By "VALLISHE."

It is always interesting to compare present-day methods of manufacture with those of the past, as it is helpful as showing the true advance a trade has made in a certain number of years. In this article the writer describes a certain method of making cast-iron square-threaded screws, first used in the year 1863—62 years ago. This method was introduced by a certain Mr. W. Bowser, a man of wide practical experience in this class of work, and there are many who will find this method comparing most favourably with the methods used to-day.

Difficulties Encountered.

The chief difficulty in moulding square-threaded screws is that of drawing the pattern from the mould. Part of the sand is liable to be displaced if common methods are employed, this causing a defective casting. This difficulty is, of course, due to the spiral curve of the thread presenting its angle of inclination parallel with the axis in opposite directions on each side thereof. The following method certainly remedies this defect and makes the withdrawal of the pattern an easy and perfectly reliable proposition.

Instead of using the ordinary two flasks, as in general practice, three flasks are brought into operation. Two flasks contain the upper and lower halves of the mould for the body of the screw. The third flask is for the mould of the head. A metal plate is attached to the ends of the two long flasks when placed together, this being made sufficiently large completely to cover the ends. In the centre of this plate is a screw-nut, this holding the

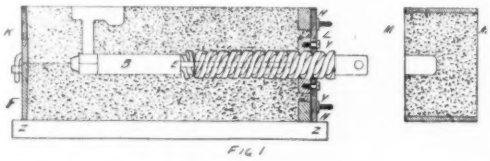


FIG. 1

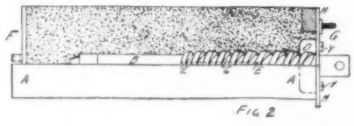


FIG. 2

pattern-screw in its correct position in the sand at the division of the two flasks to form the required mould. To remove the pattern of the body of the screw from the sand a key is placed into the end of the pattern which passes through the nut. By turning this key, the pattern is screwed out of the mould, the nut which is firmly secured to the plate affording what resistance is necessary. When this operation has been performed, the plate and nut are removed. The third flask, containing the portion of the mould in which the head of the screw is to be cast, is then joined up to the two other flasks, when the whole is ready for casting.

In Figs. 1 and 2 are shown sections of the flasks and screw in different stages.

AA is a board prepared to receive half of the pattern screw. A hollow is formed into it, so that the remaining half projects above the top of the board. B, CC, and D are the three portions of the pattern. The portion of the pattern B is furnished with a pin EE. This pin passes into a cylindrical hole in the screw portion C. This, of course, serves to guide the pattern when being screwed from out of the sand. The portion D is cut out to allow free passage for the removal of the pattern. FG is part of one of the long flasks in section, placed on the board AA. At the end G is a semi-circular aperture. This is made sufficiently large to the extent of allowing the sand to be pressed in around the collar D. HH is a metal plate screwed to the pattern collar D and flask FG, by means of two screws YY. When everything is in position as thus described, sand is filled into the flask and rammed solid to the top.

The board ZZ in Fig. 1 is next fixed to the top of the flask FG (Fig. 2). The whole lot being turned over, the board lettered ZZ is now at the bottom. The board AA is then removed, then leaving half the pattern above the sand. Next, carefully examine the first half of the mould and make good any defects that may have arisen through some unforeseen cause. When this has been done, the flask KL is then placed and secured to the flask F, and, of course, incidentally to the plate HH. The sand is then introduced into the top of the flask and well rammed up as before. The impression of the body of the screw is then complete. There should now be attached to the two long flasks the end flask MM. To accomplish this the plate HH is removed by means of the two screws YY. The end flask MM is filled with sand in order to take the impression of the head. When this has been done, the end flask MM is removed and the plate HH is once again secured to the two flasks FG and KL, and also to the collar D. Everything is now ready for the removal of the screw portion of the pattern, and when this has been done the plain portion has next to be removed. In order to do this the upper flask is separated from the lower one. The three flasks are then once more united, the mould then being completely ready, except for the runner, for making the cast. Various types of runners are used, this being a matter of personal opinion as to the best one to use, but the type shown in diagram is quite a success.

Cast-iron Railings.

By ATTICUS.

Any observant person cannot fail to have noticed that during the last twenty years cast-iron railings have been largely deposed from their functions by the use of wrought-iron. Both on chemical and practical grounds this is to be deplored. From a chemical point of view it is well known that cast-iron does not corrode in the outside atmosphere to anything like the same extent as wrought, which, from a railing point of view, is a strong feature in favour of cast-iron.

The greatest point of corrosion in railing occurs at the bottom or foot, particularly at the junction of the standards or other vertical rods, with their supporting elements, be it stone, brick or cement. A certain amount of capillary attraction is the principal cause of this, and lead as a fixing material does not help matters. From a practical point of view, the moment rails become defective at their "holding points" they are not only useless, but become a positive danger.

Wrought-iron makers have undoubtedly been more energetic and businesslike than founders in their methods of meeting requirements for railings, and it cannot be said that the latter as a class have kept up to the times in their methods of business or design.

Certain firms have done in the past, and no doubt do at the present time, a certain amount of this class of work, but how often are they prepared to go to the trouble of making fresh designs and patterns for the present-day needs or for special purposes, such as making their railings suit the style of buildings or their surroundings? A notable exception to this statement occurs to the writer, viz., the cast-iron railings and panels fixed during the last twelve months on the new promenade at Blackpool, where they constitute a unit in a general scheme of good design. If founders and designers will give some attention to this matter, there is no reason why they should not get back the greater part of the work which was formerly theirs.

A PROPOSED SCHEME to assist British exports of iron and steel, with the possible aid of the Government, is mentioned in the Sheffield Chamber of Commerce Journal. The question of a British iron and steel trades pool, says the journal, is being seriously discussed. The idea is that exports to particular markets might be aided out of the suggested pool, and there is a hint that the Government may favourably consider the idea of making a contribution to the fund in view of the revival of the German export bounty scheme.

XUM

Cupola Melting Rate as Effected by Tuyere Ratios.*

BY J. GRENNAN, Ann Arbor, Michigan.

The cupola seems to be quite a simple melting device, but the difference in construction and operation of the cupolas in different foundries is far greater than the difference in the type of castings produced would justify. Not only is there a wide difference in the cupolas in foundries producing different types of castings, but there is just as great a difference in the construction and operation of the cupolas in foundries producing the same type of castings. This is particularly true of the tuyeres.

A series of experiments were run in the foundry at the University of Michigan to see if there was any marked change in results obtained by changing the size of the tuyeres.

Equipment Used.

The cupola at the University is a No. 3 Whiting, lined to 32 in. The blower is a No. 3 Roots, driven by a variable speed motor. With this equipment it was possible to vary the size of the tuyeres and still get the same volume of air into the cupola.

The tuyeres, as furnished by the Whiting Company, consisted of four tuyeres of the continuous type. The tuyeres were each 3¼ in. by 16⅝ in. at the inside of the lining. They were equally spaced. The tuyeres had two vanes in each to distribute the blast. These vanes cut each tuyere into three sections.

Reducing the Tuyere Area.

The vanes in the tuyeres made it easy to reduce the tuyere area by stopping up the sections with clay. The first reduction was accomplished by stopping off the centre opening and leaving the sides open, making eight small tuyeres 3½ in. by 5 in. The second reduction consisted in stopping off two-thirds of each tuyere, leaving four such tuyeres. The third reduction was to reduce the 3¼ in. by 5 in. tuyeres to 3¼ in. by 2½ in. The fourth reduction was to reduce the four 3¼ in. by 5 in. tuyeres to four 2½ in. round tuyeres. Stated in terms of the ratio of tuyere area to cross sectional area, the reductions were as follows:—

Original tuyere area, 1 to 37 cross section of cupola area; first reduction equalled 1 to 6.2; second reduction equalled 1 to 12.4; third reduction equalled 1 to 25; and the fourth reduction gave a tuyere area equal to 1 to 41 of the cross section of cupola area.

Operation.

One heat was run with each reduction, except the 1 to 41 ratio, when two heats were run.

The charging of the cupola was the same in all heats. A bed charge of coke 36 in. above the tuyeres was used with a 600-lb. charge of iron, 50 per cent. pig, and 50 per cent. scrap. The succeeding charges were composed of 75 lbs. of coke and 600 lbs. of iron.

The blower was run a little faster with the 1 to 41 ratio to allow for greater loss in slippage and leaks in the piping due to higher pressure. The pressure developed by reducing the tuyeres was tested with the cupola empty, and was found to be very slight with the original tuyeres, about half an ounce for the 1 to 6.2 ratio, 1 ounce for the 1 to 12.4 ratio, 2 ounces for 1 to 25 ratio, and 3 ounces for 1 to 41 ratio. The temperature of the metal at the spout was taken with an optical pyrometer.

TABLE I.—*Heat No.* 17—*Tuyere Ratio*, 1 *to* 41.

Time P.M.	Pressure in ounces. In Windbelt	Pressure in ounces. In Cupola.	R.P.M. Blower.	Tap Number	Time P.M.	Temperature Degrees Fahr.
3 : 15	9.0	6.0	278	1	3 : 25	2664
3 : 25	10.0	7.0	278	2	3 : 30	2650
3 : 37	10.5	7.2	280	3	3 : 36	2334
3 : 45	10.4	7.1	283	4	3 : 43	2634
3 : 55	10.2	7.0	283	5	3 : 47	2602
4 : 05	10.4	7.0	280	6	3 : 51	2634
4 : 15	10.2	7.1	283	7	3 : 55	2594
4 : 25	8.5	5.0	284	8	3 : 59	2594
Average	9.9	6.7	281	9	4 : 03	2626
—	—	—	—	10	4 : 05	2634
—	—	—	—	11	4 : 10	2602
—	—	—	—	12	4 : 15	2578
—	—	—	—	13	4 : 19	2586
—	—	—	—	14	4 : 25	2586
—	—	—	—	15	4 : 29	2382
					Average	=2600

TABLE II.—*Heat No.* 18—*Tuyere Ratio*, 1 *to* 3.7.

Time A.M.	Pressure in ounces. In Windbelt.	Pressure in ounces. In Cupola.	R.P.M. Blower.	Tap Number.	Temperature Degrees Fahr.
10 : 28	6.0	5.5 oz.	265	—	—
10 : 33	7.0	7.0	275	—	—
10 : 42	8.0	7.0	272	1	2586
10 : 47	7.5	7.0	270	2	—
10 : 52	8.0	7.0	270	3	—
10 : 57	8.0	7.0	270	4	2602
11 : 02	8.5	7.5	266	5	2586
11 : 08	9.0	8.0	273	6	2586
11 : 13	8.5	8.0	—	7	2586
11 : 23	8.0	7.0	280	8	2602
11 : 28	8.0	7.0	275	9	2586
11 : 33	6.0	5.0	272	10	2570
Average	7.7	6.9	271.6	—	2588

TABLE III.—*Heat No.* 19—*Tuyere Ratio*, 1 *to* 3.7.

Time P.M.	Pressure in ounces. In Windbelt.	Pressure in ounces. In Cupola.	R.P.M. Blower.	Tap Number.	Temperature Degrees Fahr.
3 : 00	6.5	6.5	280	—	—
3 : 05	7.0	7.0	270	—	—
3 : 13	8.0	8.0	270	1	2650
3 : 18	8.0	8.0	270	2	2678
3 : 25	8.5	8.0	270	3	2685
3 : 32	8.5	8.0	270	4	2678
3 : 39	7.5	6.5	270	5	2642
3 : 46	6.5	5.5	285	7	2594
3 . 51	4.5	3.5	290	8	2570
Average	7.2	6.7	274	—	2642

Tables I, II and III give the pressures in the wind belt and inside the cupola at the level of the tuyeres and the temperatures of the metal.

The average temperature of the metal from the heat with the tuyere ratio 1 to 41 was 1,425 deg. C. This is between the average temperature of the two heats with the tuyeres 1 to 3.7. The average temperatures of which were 1,320 deg. C. and 1,450 deg. C. The pressure inside the cupola showed very little variation. There was 0.2 of an ounce of difference inside the cupola between heats 17 and 18. The building up of the pressure was greater with the large tuyeres than the small ones, probably because the small tuyeres were kept cleaner due to the small area.

Conclusions.

The results obtained by these experiments indicate that there is nothing vital in the sizes of the tuyeres. Foundrymen may discard the idea that small tuyeres will have any marked influence on melting. If their cupola is not working regularly they need not blame small tuyeres for their trouble. It might be advisable to use large tuyeres, but within the limits of the sizes in use no foundryman is justified in changing his cupola tuyeres except at such convenient times as when relining the cupola.

The difference in pressure due to the smaller tuyeres would increase the power required to drive the blower.

An Ideal Tuyere.

An ideal set of tuyeres is one in which there is the minimum amount of friction offered to the passages of air into the cupola and one which distributes the air uniformly around the cupola. The continuous tuyere of a 1 to 4 ratio satisfies these requirements.

THE DIRECTORS of the Falkirk Iron Company, Limited, propose to substitute for the £168,900 8 per cent. first mortgage debentures now outstanding a series of debentures carrying 6 per cent. interest. It has been decided that the amount to be issued in substitution be limited to £130,000.

SOME 200 MEMBERS attended the inaugural meeting of the session of the Newcastle and District Branch of the Institute of British Foundrymen, held on Saturday last. Mr. M. B. Herbst (president) occupied the chair. "A Description of the Perlit Process" was the subject of a paper read by Mr. H. J. Young, of Whitley Bay, who stated that would probably be his last paper as a member of the Newcastle Branch. Mr. Young, who is chief chemist to the North-Eastern Marine Engineering Company, Limited, is leaving for London, where he is commencing business as a consulting metallurgist.

* Abstract from a Paper read before the Syracuse Meeting of the American Foundrymen's Association.

† Foundry Instructor, University of Michigan.

The "VULCANIA" PATENT WHEEL MOULDING MACHINE.

Patent No. 5049.

THE "VULCANIA" PATENT WHEEL MOULDING MACHINE is for moulding spur wheels with straight, sloping or Vee-shaped teeth, also bevel wheels, skew gear wheels, worm wheels and internal wheels. The machine head is carried on a pillar which is held in a base-plate bedded in the floor sand, and is made to slide on the pillar by means of a lever and link carried on a joint bearing, or by rack and pinion, or screw if thought advisable for the particular work it is being used for.

An adjustable stop collar is provided for accurately deciding the depth of mould. On the removable head a slide is carried for supporting the patterns of the teeth to be moulded. This slide is made adjustable by screw or pinion gearing to the diameter required. The number of teeth to be moulded is decided by a special dividing plate into which a steel wedge or finger engages. The special dividing plate has milled vees, at the angle of 60° inclusive, around its circumference, to receive the steel wedge, which is adjusted by a screw having an internal spring to keep it in tension and to lock the head when ramming operations are being carried out.

JAMES EVANS & CO., BRITANNIA WORKS, (MANCHESTER), LIMITED,

BLACKFRIARS, MANCHESTER.

Trade Talk.

THE WIGAN COAL AND IRON COMPANY, LIMITED, have decided to blow out two blast furnaces.

A CONTRACT for 24 large barges for harbour and river use has been placed by foreign firms with Henry Robb, Limited, of Leith.

PETTERS, LIMITED, of Yeovil, have been awarded a gold medal for their oil engine exhibit at the recent Caldas da Rainha Exhibition.

IN THE NINE MONTHS JUST ENDED Belfast shipbuilders launched ten vessels of 57,240 tons, as against nine of 92,028 tons in the corresponding period of 1924.

AN EFFORT IS BEING MADE by the British nail-making industry to obtain from the Government some protection under the Safeguarding of Industries Act.

CONSIDERABLE damage was caused by a fire at the British Thomson-Houston Company's works, Rugby, which broke out on Tuesday of last week. The roof of the test department was destroyed.

THE AVERAGE NET SELLING PRICE of Scottish manufactured iron during July and August was £11 16s. 9.6d. This means that there will be a decrease in the wages of the workmen of 2½ per cent.

A FIRE, involving great damage, recently broke out at the works of Vickers, Limited, at Dartford, Kent. The woodworking plant and paint shops were destroyed, but employment has now been found for all the men affected.

ALFRED HOLT & COMPANY have decided to reduce by 15 per cent. the scantlings of the deck equipment of their two new steamers, building with Workman, Clark & Company, Limited. This equipment was originally made in grey iron, but is now made in "Perlit" iron.

THE BLACKFRIARS FOUNDRY EQUIPMENT COMPANY (proprietor, Mr. F. J. Barraball) has removed from 181, Queen Victoria Street, to 34 35, Norfolk Street, Strand, W.C.2. The stores depôt remains unchanged at Maiden Lane, L.M. & S., King's Cross, the telephone number of which is North 2927.

BARCLAY, CURLE & COMPANY, LIMITED, of Scotstoun, have an order from the British India Steam Navigation Company, Limited, for a vessel of about 8,500 tons deadweight. This company have also given a contract for a similar vessel to R. & W. Hawthorn, Leslie & Company, Limited, of Newcastle-on-Tyne.

AS ALREADY STATED, the business of W. S. Laycock, Limited, of Sheffield, has been acquired by the Laycock Engineering Company, Limited. This company was formed by the Metropolitan Carriage, Wagon & Finance Company, Limited, and the Birmingham Railway Carriage & Wagon Company, Limited, who have equal holdings of the nominal capital of £5,000 in £1 shares.

KITSON & COMPANY, LIMITED, of Leeds, have booked an order for three locomotives for the Midland Railway of Australia, and for two tank locomotives for the Barsi Railway, India. The Therezopolis Railway of Brazil has ordered a rack locomotive from Sir W. G. Armstrong, Whitworth & Company, Limited. The North British Locomotive Company, Limited, of Glasgow, have a contract for the construction of 15 express locomotives for use on the South Eastern section of the Southern Railway.

SIR WILLIAM BIRD, at the annual meeting of the Staveley Coal and Iron Company, Limited, explained that at the last annual meeting the directors were given authority to acquire an interest in Markham & Company, Limited, on which they had relied for repairs for some years. It was arranged to be taken over at what was nominally a gift from Mr. Markham, for £150,000, payable in cash, which had been provided by Mr. Markham, and the capital of the new company was to be £5,000 only, in 5,000 £1 shares, which had been subscribed at par by the Staveley Company with the exception of the shares of the two signatories.

SOME INTERESTING references to the value of piece work were made by Mr. J. G. Stephen at the trial trip of the twin-screw turbine liner "Caledonia," built by Alexander Stephen & Sons, Limited, Glasgow, for the Anchor Line. Mr. Stephen said those who read the newspapers were apt to be misled into thinking that most of a ship was built on the piece work system. Shipbuilders only wished that were true. Several unions, notably the Woodworkers' Union, would not allow their men to work on piece work. Last week only 18 per cent. of the men working at their Linthouse yard were on piece work. There was no doubt that piece work was an advantage to the individual man, financially at any rate. The average wage of the piece worker was 26½ per cent. greater than the average of time workers. There was also no doubt that piece work was an advantage to the employer, as whenever any particular job which had previously been carried out on time work was done by piece work they invariably found that it was done not only by fewer men, but in a shorter time. It was absolutely incredible that some trade unions would not permit piece work, especially when costs had to be kept down to meet foreign competition.

Company News.

Wm. Beardmore & Company, Limited.—Dividend on preference shares for half-year to June 30 last passed.

Special Steel Company, Limited, Bacon Lane, Sheffield.—Capital £2,000 in £1 shares. Secretary: B. Beardshaw.

Birmingham Small Arms Company, Limited.—Dividends for six months ended July 31 on "A" and "B" preference shares.

Stanton Ironworks Company, Limited.—Dividend on preference shares for half-year to September 30, 6 per cent. per annum, less tax.

Bell's United Asbestos Company, Limited.—Interim dividend on ordinary shares, 6d. per share, being 2½ per cent. (actual), less tax.

United Foundry and Pattern Company (Chiswick), Limited, Loretto Wharf, Thames Road, Chiswick, W.—Capital £1,000 in £1 shares.

Sir W. G. Armstrong, Whitworth & Company, Limited.—Usual interim dividends on various shares of company passed, except on first (cumulative) preference shares.

J. B. Corrie & Company, Limited, 15, Victoria Street, Westminster, London, S.W.1.—Capital £5,000 in £1 shares. Engineers. Directors: J. B. Corrie, A. G. Corrie, B. J. B. Corrie and A. V. Piper.

James Robinson & Company (Bolton), Limited, Chulsey Street Works, Deane Church Lane, Bolton.—Capital £5,000 in £1 shares. Crucible steel and iron casting makers. Directors: J. Robinson and T. L. Clayton.

Vulcan Foundry, Limited.—Charged against revenue account for repairs and depreciation, £43,661; profit, £77,563; balance of undistributed profits standing to credit of revenue reserve account, £184,918; dividends for year, 5 per cent. on preference shares and 8½ per cent. on ordinary; carried forward, £110,585.

Kayser, Ellison & Company, Limited.—Net profit, £25,546; arrears of preference dividend to June 30, 1924, paid, £12,000; credit balance from previous year, £2,561; available for disposal, £28,107; preference dividend to June 30, 1925, £6,000; dividend on ordinary shares, 5 per cent., £12,500, both less tax; carried forward, £9,607.

Ibbotson Brothers & Company, Limited.—The 53rd annual meeting was held on Monday at the Globe Steel Works, MR. C. J. WALSH (managing director) presiding, in the absence of Mr. F. J. Talbot. The report and balance-sheet were adopted, and a dividend was declared of 6s. per share, making 7½ per cent., tax free, for the year ended June 30, carrying forward £73,543, including £71,476 brought forward. The retiring directors, Messrs. F. J. Talbot (chairman) and J. H. Chapman, were re-elected.

Personal.

MR. J. E. DAVIDSON, managing director of the United Alkali Company, Limited, has resigned his position, but retains his seat on the board.

DR. G. C. CLAYTON, M.P., and Professor H. C. H. Carpenter have been appointed members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

MR. JAMES WILKIE has been appointed general manager of the engineering department of Workman, Clark & Company, Limited, Belfast. Mr. Wilkie has been with the firm for the past eighteen years, during which he occupied the position of outside manager and latterly that of chief draughtsman.

MR. H. S. BURN, a local director of Thos. Firth & Sons, Limited, Sheffield, is relinquishing his post of chief engineer after seventeen years' service, to take up the position of chief engineer of the Imperial Tobacco Company, Limited. He has been the recipient of a presentation from the officials and men at Sheffield.

MR. N. J. KERR, accountant to David Colville & Sons, Limited, has been appointed secretary of the company, in succession to Mr. Wm. Torrance, who recently retired from that position. Mr. D. J Pinkerton, for many years chief chemist at the Dalzell Works, and latterly in charge of the metallography department, has received a handsome presentation from the officials and staff on the occasion of his retirement.

Wills.

MICKLETHWAIT, W. H., The Red House, Whiston, Rotherham, stove grate manufacturer £64,962

LINDLEY, R. S., for many years managing director of Vivian & Sons, Limited, Hafod Copper Works, near Swansea ... £109,198

FIRTH, T. H., Prior Bank, Cherry Tree Road, Sheffield, chairman of the Brightside Foundry & Engineering Company, Limited £39,149

Sterling

STERLING
MOULDING BOXES

THE SECRET OF THE STRENGTH
AND DURABILITY OF STERLING BOXES
LIES IN THE ROLLED STEEL CONSTRUCTION.

HAVE YOUR NEXT LOT OF BOXES MADE IN
ROLLED STEEL

Light in Weight—Easy to Handle—Strong and Durable—Absolutely Accurate.

OVER 600,000 STERLING BOXES HAVE BEEN SOLD

3,500 FOUNDRIES ARE NOW USING STERLINGS

STERLING FOUNDRY SPECIALTIES LTD. BEDFORD
LONDON OFFICE, 13, VICTORIA STREET, S.W.1.

GANISTER, CUPOLA BLOCKS, FIRE BRICKS,
FIRE CLAY.

Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & Co., Ltd.
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

SIEMENS' STEEL PROCESS

BOILER, SHIP and BRIDGE PLATES, etc. ANGLES and all forms of Sectional Bars. TYRES and AXLES to all requirements. CASTINGS of all kinds and of Largest Sizes. FORGINGS of every description. BILLETS, BLOOMS, RAILS.

SPECIAL STEEL FOR CONSTRUCTIVE PURPOSES.

The STEEL COMPANY OF SCOTLAND, Ltd.

Head Office: 23, ROYAL EXCHANGE SQUARE, GLASGOW.
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IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—Surveying the present position of the Cleveland iron trade there would appear to be some slight improvement in the outlook, it having become fairly evident of late that buying on autumn account indicates some measure of returning confidence, while markets are distinctly steadier in tendency. There is further more disposition to fix up forward business over the last quarter than has been experienced for some time past. There can be, moreover, no doubt that values have now fallen to a very unprofitable level as far as the producers are concerned, and, having regard to the smallness of the output, the point appears to have been reached when the "bears," who have had it all their own way for so long, will need to be cautious. It would not take a very big improvement in business to harden values appreciably. On the export side the outlook is perhaps a little more hopeful. Even with the present big difference in price, there is a steady sale of moderate lots of Cleveland iron to Continental buyers, who are accustomed to using it. This week again quotations are lower as follow:—No. 3 G.M.B., 66s. 6d.; No. 1 foundry, 70s.; No. 4 foundry, 65s. 6d.; and No. 4 forge, 65s. per ton.

In the hematite section also export inquiry has been on a more active scale, and some good sales have been effected, in spite of the fact that the price is well above that accepted for Continental descriptions. The home trade is fairly steady, though still on a very restricted basis. The price of East Coast mixed numbers is now down to 74s., with the No. 1 quality 74s. 6d. per ton. On the North-West Coast prices are unchanged, Bessemer mixed numbers being quoted at £4 2s. 6d. c.i.f. Welsh ports, £4 4s. per ton at Glasgow, £4 7s. at Sheffield, and £4 12s. 6d. at Birmingham.

LANCASHIRE.—Business in foundry pig in this area appears still as languid as previously reported, with sales almost entirely confined to what would be regarded in ordinary times as retail parcels. Prices are to some extent difficult to gauge with accuracy. Derbyshire No. 3 foundry being reported sold at 73s. 6d., and even sixpence less the ton, while both Lincolnshire and Northants makes are quotably lower. There seems no doubt that local merchants generally take an unfavourable view as to the course of prices during the remainder of the year, and that those who are accustomed to "bear" transactions will take every opportunity of securing what few forward contracts are available, and these, of course, are not many.

THE MIDLANDS.—In the South Staffs districts the demand for foundry pig continues unsatisfactory in volume, the heavy ironfounders being short of work, while consumption for light castings is obviously on a lower scale. There has been little change in quotations, which rule as follow:—Derbyshire No. 3 foundry, 65s. to 67s. 6d.; Staffordshire No. 3 foundry, 67s. 6d.; Northants No. 3 foundry, 61s. to 62s. 6d.

SCOTLAND.—As the result of contracts running out, there has been a slightly better demand for Cleveland iron from the light casting founders. Purchases made have been for early delivery, but the total tonnage has not been large. For Scotch iron there has been very little demand, and prices are steady on the basis of 80s. for No. 3 at the furnaces. It is expected that two furnaces will be put into blast on Scotch foundry shortly, in order to replenish stocks which have become exhausted.

Finished Iron.

Conditions in the various sections of the manufacturing branches continue without appreciable improvement, the demand for all classes of finished material remaining exceptionally quiet, with keen competition for any fresh orders coming into the market, as previously suggested might be the case, and values of bar iron have been reduced. For some time it has been possible to buy crown iron at £12 per ton delivered South Staffs district, although this was 7s. 6d. per ton below the nominal Association figure. The lower price was due to the cutting in by makers of iron outside the Association, and the Associated makers have now reduced their prices to the same level.

Steel.

In the market for semi-products billets continue weak, and it is reported that soft varieties can be purchased at under £6 5s. delivered, and that there are several sellers at round this figure. So far as sheet and tinplate bars are concerned the demand is exceptionally poor, and this branch of the industry is at present experiencing conditions which are likely to continue until the imports of foreign semis are reduced. Business in the tinplate market has taken a firmer turn, with prices steady up to 19s. 6d., basis I.C. f.o.b. works port, with few plates available at a lower quotation. The Continent, the Far East, and South America are buyers, and home consumers have taken odd sizes. Wasters continue in demand for both home and export.

Scrap.

Not the slightest improvement can be noted in the state of scrap markets generally, the demand continuing almost negligible, and purchases reduced to the minimum requirements. Inquiries for cast scrap from the Lancashire ironfoundries are only small, and the prices seem a little uncertain. The weakness of pig-iron induces the ironfounders to believe that cast scrap ought to be cheaper, and in some cases less than 70s. per ton is being offered for good scrap material. Local dealers, as a rule, want 72s. 6d. for broken machinery scrap, and in some parts of the county up to 75s. is asked, but there is no doubt that the tone of the market is weak. In Scotland business is also poor, good clean heavy shovelling turnings being bought at 50s. to 51s. 6d., and for cast-iron borings 47s. 6d. to 48s. 6d. per ton. The latter is in better demand. Machinery cast-iron scrap shows no change at 71s. 3d. to 72s. 6d. per ton.

Metals.

Copper.—Due to recent unfavourable American advices the outlook for standard copper has developed a weaker tendency in values, although the change is regarded as temporary only. Generally, consumers are reported to have amply covered their requirements for some little time ahead. No doubt the market will recover from the present weakness, for the price of standard is admittedly low, but what is required is some real improvement in European demand, and progressive development on the Continent. Current quotations:—*Cash*: Thursday, £61 12s. 6d.; Friday, £61 17s. 6d.; Monday, £61 12s. 6d.; Tuesday, £61 5s.; Wednesday, £61 7s. 6d.

Three Months: Thursday, £62 10s.; Friday, £62 15s.; Monday, £62 10s.; Tuesday, £62 5s.; Wednesday, £62 5s.

Tin.—More active buying on both sides of the Atlantic of late has induced a better sentiment in tin market movements, and values have consequently responded by a substantial recovery. The home demand continues light, but better purchases have been made on Continental account. The outlook seems bright enough, although there is some little uncertainty as regards the American demand pending a solution of the coal labour troubles. Shipments of tin from the Straits during September totalled at 4,553 tons, of which 2,825 tons were for the United States, 1,145 tons for the United Kingdom, and 583 tons for the Continent. Current quotations:—*Cash*: Thursday, £269; Friday, £269; Monday, £268 15s.; Tuesday, £269 15s.; Wednesday, £271.

Three Months: Thursday, £269 12s. 6d.; Friday, £269 15s.; Monday, £269 5s.; Tuesday, £270 10s.; Wednesday, £272.

Spelter.—The statistical position of this metal continues satisfactory, the world-production being below actual consumptive requirements. American stocks are comparatively small at 17,000 tons, while Belgian production is below the total reached a few months ago, with the consequent result that values are maintained at steady levels. Current quotations:—*Ordinary*: Thursday, £38 10s.; Friday, £38 17s. 6d.; Monday, £39 6s. 3d.; Tuesday, £39 11s. 3d.; Wednesday, £39 11s. 3d.

Lead.—The market for soft foreign pig continues firm with values again advanced, due to the absence of offers of near metal and limited arrivals. Consumers are again buying freely, and some dealers being rather short, market conditions remain stringent. Current quotations:—*Soft foreign (prompt)*: Thursday, £40 2s. 6d.; Friday, £40 5s.; Monday, £39 15s.; Tuesday, £39 13s. 9d.; Wednesday, £38 17s. 6d.

AS THE RESULT OF THE CLOSING of the Dillwyn Spelter Works, Swansea, some 200 men are affected. Notices to some of the men expired last week.

AT THE MEETING of the Refractory Materials Section of the Ceramic Society, held in London on September 16, Mr. F. Russell, of the General Refractories Company, Limited, Sheffield, was elected to the council to represent the Sheffield and Lincolnshire district, along with the existing members, Mr. H Wragg, M.P., and Mr. W. J. Gardner.

CATCHING ALL THE BIG 'UNS

THE LARGEST

foundries in this country and many abroad are now regular and satisfied users of

"SILACENE"

The super refractory for setting, plastering and patching the lining of all kinds of furnaces, from stoves and grates to the largest Siemens O.H. me'ting plant.

THOMAS E. GRAY & CO., LTD.

The Makers of "SILACENE,"

119, HIGH HOLBORN, LONDON, W.C.1

ESTABLISHED 1877.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash ..	61	7	6
Three months ..	62	5	0
Electrolytic	66	12	6
Tough	63	10	0
Best selected ..	64	0	0
Sheets	92	0	0
India	78	0	0
Wire bars	67	0	0
Do. Oct.	66	12	6
Do. Oct.-Nov. ..	66	15	0
Ingot bars	66	12	6
H.C. wire rods ..	71	0	0
Off. av. cash, Sept.	61	18	11 5/11
Do., 3 mths. Sept.	62	18	2 5/11
Do., Sttlmnt, Sept.	61	18	0 9/11
Do., Electro, Sept.	67	18	2 5/11
Do., B.S., Sept. ..	65	14	2
Aver. spot price copper, Sept. ..	61	18	0¾
Do., wire bars, Sept.	68	2	6
Solid drawn tubes			13½d.
Brazed tubes ..			13½d.
Wire			10d.

BRASS.

Solid drawn tubes ..	12d.
Brazed tubes	13½d.
Rods, drawn	11⅛d.
Rods, extd. or rlld. ..	7½d.
Sheets to 10 w.g ..	10⅜d.
Wire	10⅛d.
Rolled metal	9¾d.
Yellow metal rods ..	7½d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets ..	8½d.

TIN.

Standard cash ..	271	0	0
Three months ..	272	0	0
English	271	0	0
Bars	271	15	0
Straits	277	5	0
Australian	273	5	0
Eastern	276	0	0
Banca	276	15	0
Off. aver. cash, Sept.	259	3	8 5/12
Do., 3 mths., Sept.	261	0	0
Do., Sttlmt. Sept.	259	3	7 7/11
Aver. spot., Sept.	259	3	7½

SPELTER.

Ordinary	39	11	3
Remelted	38	0	0
Hard	31	15	0
Electro 99.9 ..	43	17	6
English	40	2	6
India	33	0	0
Zinc dust	44	0	0
Zinc ashes	15	0	0
Off. aver., Sept.	37	1	6 9/11
Aver., spot, Sept.	37	8	8¼

LEAD.

Soft foreign ppt.	38	17	6
English	40	5	0
Off. average, Sept.	37	12	10 11/12
Average spot, Sept.	38	17	8

ZINC SHEETS, &c.

Zinc sheets, English	44	0	0
Do. V.M. ex whf.	43	10	0
Rods	50	0	0
Boiler plates ..	42	0	0
Battery plates ..	42	10	0

ANTIMONY.

Special brands, Eng.	74	10	0
Chinese	66	10	0
Crude	62	0	0

QUICKSILVER.

Quicksilver ..	13	0	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro silicon			
45/50%	12	10	0
75%	21	5	0
Ferro-vanadium—			
35/40%	16/3 lb. va.		
Ferro-molybdenum—			
70/75% c. free ..	6/3 lb.		
Ferro-titanium—			
23/25% carbonless	1/1 lb.		
Ferro-phosphorus, 20/25%,	£22	0	0
Ferro-tungsten—			
80/85% c.fr.	1/8 to 1/8½ lb.		
Tungsten metal powder—			
98/99%	1/11 to 1/11½ lb.		
Ferro-chrome—			
4/6% car. ..	£23	10	0
6/8% car. ..	£23	0	0
8/10% car. ..	£22	10	0
Ferro-chrome—			
Max. 2% car.	£40	5	0
Max. 1% car.	£51	12	6
Max. 0.70% car.	£56	0	0
70%, carbonless	1/5 lb.		
Nickel—99%,			
cubes or pellets £170 to £175			
Cobalt metal—98/99%	10/– lb.		
Aluminium 98/99%	£120		
Metallic Chromium—			
96/98% ..	3/9 lb.		
Ferro-manganese (net)—			
76/80%, loose	£15	7	6
76/80%, packed	£16	7	6
76/80%, export	£15	5	0
Metallic manganese—			
94/96%, carbonless	2/– lb.		
Per ton unless otherwise stated.			

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten ..	s. d. 2 6
Finished bars, 18% tungsten ..	3 0
Per lb. net, d/d buyers' works.	
Extras—	
Rounds and squares 3 in. and over ..	4d. lb.
Rounds and squares under ½ in. to ¼ in.	3d. lb.
Do. under ¼in. to ⅜ in.	1/– lb.
Flats, ½in. × ¼in. to under 1 in. × ⅜ in.	3d. lb.
Do. under ½in. × ¼in.	1/– lb
Bevels of approved sizes and sections	6d. lb.
Bars cut to length 10% extra	
Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turningds and warf	1d.
Per lb. net, d/s steel makers' work	

SCRAP.

South Wales—	£	s.	d.
Hvy. steel	3 7 6 to 3	10	0
Bundled steel & shrngs.	3 2 6 to 3	6	0
Mixed iron & steel	3 2 6 to 3	5	0
Heavy cast iron	3	6	0
Good machinery for foundries	3	10	0
Cleveland—			
Heavy steel ..	2	17	6
Steel turnings ..	1	17	6
Cast iron borings	1	15	0
Heavy forge ..	3	17	6
Bushelled scrap	3	2	6
Cast-iron scrap	3 2 6 to 3	7	6
Lancashire—			
Cast-iron scrap ..	3 10 0 to 3	12	6
Heavy wrought	3 5 0 to 3	7	6
Steel turnings ..	2	3	0
London — Merchants' buying prices delivered yard.			
Copper (clean)..	53	0	0
Brass (clean) ..	40	0	0
Lead (less usual draft)	35	10	0
Tea lead ..	31	10	0
Zinc	25	0	0
New aluminium cuttings ..	92	0	0
Braziery copper	48	0	0
Gunmetal ..	48	0	0
Hollow pewter	180	0	0
Shaped black pewter ..	130	0	0

PIG-IRON.

(*f.o.t. unless otherwise stated*).

N.E. Coast—	
Foundry No. 1 ..	70/–
Foundry No. 3 ..	66/6
Foundry No. 4 ..	65/6
Forge No. 4	65/–
Hematite No. 1 ..	74/6
Hematite M/Nos. ..	74/–
N.W. Coast—	
Hem. M/Nos. d/d Glas.	84/–
,, d/d Birm.	92/6
Midlands—	
Staffs. common* ..	—
,, No. 4 forge ..	62/6
,, No. 3 foundry	67/6
Shrops. basic	70/–
,, Cold blast, ord.*	185/–
,, ,, roll iron* ..	190/–
* d/d Birmingham.	
Northants forge	56/6
,, fdry No. 3 ..	61/6
Derbyshire forge ..	57/6
,, fdry. No. 3 ..	66/3
,, basic	67/6
Scotland—	
Foundry No. 1 ..	85/–
,, No. 3 ..	80/–
Hem. M/Nos.	80/–
Sheffield (d/d district)—	
Derby forge	61/6
,, fdry. No. 3 ..	69/–
Lincs. forge	69/–
,, fdry. No. 3 ..	71/6
E.C. hematite	84/6
W.C. hematite ..	87/–
Lincs. (at furnaces)—	
Forge No. 4	63/–
Foundry No. 3.. ..	65/–
Basic	63/6
Lancashire (d/d eq. Man.)—	
Derby forge	65/–
,, fdry. No. 3 ..	73/6
Northants foundry No. 3	74/6
Dalzell, No. 3	110/–
Summerlee, No. 3 ..	97/6
Glengarnock, No. 3 ..	97/6
Gartsherrie, No. 3 ..	97/6
Monkland No. 3	97/6
Coltness, No. 3	97/6
Shotts, No. 3	97/6

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars(cr.)	11 12 6 to 12			10	0	
Angles	12			7	6	
Tees to 3 united ins.	13			2	6	
Nut and bolt ..	11			0	0	
Hoops	14 0 0 to 15			0	0	
Marked bars (Staffs.) f.o.t. ..	14			10	0	
Gas strip	12			15	0	
Bolts and nuts .. ⅞ in. × 4 in. ..	16			15	0	
Steel—						
Ship plates	8 0 0 to 8			15	0	
Boiler plts.	12			0	0	
Chequer plts.	£9 15 to 10			5	0	
Angles	£7 10 0 to 8			0	0	
Tees	£8 10 0 to 9			0	0	
Channels	£7 5 0 to 7			15	0	
Joists	£7 10 0 to 8			0	0	
Rounds and Squares 3 in. to 5½ ins. ..	9			0	0	
Rounds under 3 in. to ⅞ in.	8			15	0	
Flats, over 5 in. wide and up ..	9			10	0	
Flats, 5in. to 1½in.	8			10	0	
Rails, heavy ..	8			10	0	
Fishplates	12			10	0	
Hoops (Staffs.) ..	10			10	0	
Black sheets, 24g.	11			5	0	
Galv. cor. sheets, 24g.	16			5	0	
Galv. fencing wire 8g. plain	14			0	0	
Billets, soft	£6 5 0 to 7			15	0	
Billets, hard ..	8			12	6	
Sheet bars	£6 5 0 to 6			15	0	
Tin bars d/d	£6 5 0 to 6			15	0	

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	3
Sheet to w.g.	1	3½
Wire	1	3¾
Rods	1	3
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising 9d. to 1/3	
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks ..	9d. to 1/5½
Ingots rolled to spoon size ..	1/– to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	22.26
No. 2 foundry, Valley	20.76
No. 2 foundry, Birm.	18.50
Basic	20.26
Bessemer	21.26
Malleable	20.76
Grey forge	20.26
Ferro-mang. 80% d/d	115.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	35.00
O.-h. billets	35.00
O.-h. sheet bars ..	35.00
Wire rods	45.00
	Cents.
Iron bars, Phila. ..	2.12
Steel bars	1.90
Tank plates	1.80
Beams, etc.	1.90
Skelp, grooved steel ..	1.90
Skelp, sheared steel ..	1.90
Steel hoops	2.40
Sheets, black, No. 28..	3.15
Sheets, galv., No. 28 ..	4.20
Sheets, blue an'l'd, 9 & 10	2.25
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv. ..	3.35
Tinplate, 100 lb. box	£5.50

COKE (at ovens).

Welsh foundry	37/6
,, furnace ..	27/6
Durham & North.	
,, foundry ..	35/–
,, furnace ..	14/6
Other Districts, foundry	35/–
,, ,, furnace	11/6 to 13/6

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes, 20×14, box		19/6
,,	28×20, ,,	39/–
,,	20×10, ,,	29/3
,,	18¾×14, ,,	20/4½
C.W.	20×14, ,,	17/10½
,,	28×20, ,,	35/10½
,,	20×10,	25/1½
,,	18¾×14, ,,	18/6

Terneplates 28×20, 36/4½ per box basis f.o.b.

SWEDISH IRON.

Bars, hammered	£19/0 to £20/0
Rolled Ord.	£16/0/0 to £16/10/0
Nail rods	£16 5 0 to £16 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£10 to £14
Pig-iron	£6 15 0 to £7 0 0

all f.o.b. Gothenburg.

TUBES.

Up to and incl. 6 in.

Gas .. 55% } Tube prices
Water .. 50% } are
Steam .. 45% } now free.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.		
Oct. 1	61	12	6	inc.	10/–
,, 2	61	17	6	,,	5/–
,, 5	61	12	6	dec.	5/–
,, 6	61	5	0	,,	7/6
,, 7	61	7	6	inc.	2/6

Electrolytic Copper.

	£	s.	d.		
Oct. 1	67	5	0	inc.	15/–
,, 2	67	5	0	No change	
,, 5	67	0	0	dec.	5/–
,, 6	66	10	0	,,	10/–
,, 7	66	12	6	inc.	2/6

Standard Tin (Cash).

	£	s.	d.		
Oct. 1	269	0	0	inc.	50/–
,, 2	269	0	0	No change	
,, 5	268	15	0	dec.	5/–
,, 6	269	15	0	inc.	20/–
,, 7	271	0	0	,,	25/–

Tin (English ingots).

	£	s.	d.		
Oct. 1	269	10	0	inc.	60/–
,, 2	269	10	0	No change	
,, 5	269	0	0	dec.	10/–
,, 6	269	15	0	inc.	15/–
,, 7	271	0	0	,,	25/–

Zinc Sheets (English).

	£	s.	d.		
Oct. 1	44	0	0	No change	
,, 2	44	0	0	,,	,,
,, 5	44	0	0	,,	,,
,, 6	44	0	0	,,	,,
,, 7	44	0	0	,,	,,

Spelter (ordinary).

	£	s.	d.		
Oct. 1	38	10	0	dec.	2/6
,, 2	38	17	6	inc.	7/6
,, 5	39	6	3	,,	8/9
,, 6	39	11	3	,,	5/–
,, 7	39	11	3	No change	

Lead (English).

	£	s.	d.		
Oct. 1	40	15	0	inc.	5/–
,, 2	41	0	0	,,	5/–
,, 5	40	15	0	dec.	5/–
,, 6	40	10	0	,,	5/–
,, 7	40	5	0	,,	5/–

Sweden.—Imports of Iron and Steel.

Year.	Pig-iron.	Joists, angles, etc.	Plates and sheets.	Tinplates.	Rails.	Pipes and tubes.	Unenumerated.	Total.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.
1913	94,600	49,600	16,600	8,500	58,000	27,400	—	254,700
1914	103,200	46,300	16,700	5,900	52,700	23,800	—	248,600
1915	111,400	59,500	26,900	5,400	23,400	24,300	—	250,900
1916	92,500	88,500	41,300	5,200	34,300	30,900	—	292,700
1917	42,800	20,900	15,900	200	1,600	16,500	—	97,900
1918	18,111	39,800	16,412	218	21,419	13,423	—	100,383
1919	20,501	22,200	24,517	7,118	33,589	13,989	—	130,914
1920	37,454	66,631	48,721	7,788	58,952	28,252	—	247,798
1921	11,251	33,732	24,334	3,300	42,371	13,340	—	128,328
1922	21,403	41,782	14,381	7,300	26,648	27,555	—	139,069
1923	34,900	60,700	39,700	7,900	12,100	31,000	1,500	187,800
1924	44,000	90,100	37,200	8,400	79,200	30,700	1,400	291,000

Sweden.—Exports of Iron and Steel.

Year.	Pig-iron and ferro.	Blooms and billets.	Wire rods.	W.I. bars.	Tubes and tube blanks.	Unenumerated	Total.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.
1913	186,100	54,800	—	—	—	261,700	502,600
1914	162,800	35,900	—	—	—	184,100	382,800
1915	290,200	55,300	—	—	—	243,400	588,900
1916	227,000	65,900	—	—	—	270,200	560,100
1917	231,200	51,200	—	—	—	205,200	487,600
1918	194,111	34,134	32,155	69,229	7,470	8,910	348,485
1919	89,072	13,728	19,408	70,264	9,525	5,183	210,392
1920	125,520	12,999	13,831	67,101	11,937	9,165	245,233
1921	88,387	4,122	6,478	26,632	3,249	3,262	133,726
1922	53,032	14,679	12,412	44,185	7,242	4,744	140,938
1923	115,900	11,700	14,200	46,000	6,500	38,600	232,900
1924	104,600	13,700	21,200	69,600	21,500	32,000	262,600

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

18, BENNETTS HILL, BIRMINGHAM.
11, OLD HALL STREET, LIVERPOOL.
EXCHANGE BLDGS., PORT TALBOT.
FOWLERS BUILDINGS, BOMBAY.
CLIVE STREET, CALCUTTA.
ANGAPPA NAICK STREET, MADRAS.

REGISTERED TRADE MARK

1, HONG KONG ROAD, SHANGHAI.
OCEAN BUILDING, SINGAPORE.
JAVA STREET, KUALA LUMPUR
5, SHAFFRAZ ROAD, RANGOON.
COX'S BUILDINGS, KARACHI.
P.O. BOX 1580, CAIRO.

PIG IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.,

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM COLVIN & COMPANY,

ROYAL EXCHANGE, MIDDLESBROUGH.

93, HOPE STREET, GLASGOW.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 7 words per line. Minimum charge for one insertion 3/-.

SITUATIONS VACANT AND WANTED.

FOUNDRY FOREMAN, age 45, requires position; practical knowledge of Dry and Green Sand Castings; also experienced with Jar-ram and Squeezing Machines.—Box W. A. G., Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2

FOREMAN MOULDER, Brass or Iron, seeks position; age 43 years; 15 years' experience as Foreman Moulder; Marine, Oil Engines, Hydraulic, Textile, Railroad, Crane and Mining Work; willing to go anywhere.—Box 468, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOUNDRY FOREMAN, disengaged, desires position; 22 years' experience; Engineering and Jobbing work; mix Grey Iron, Semi-steel, Non-ferrous Metals by analysis; can get maximum production and take charge of pattern shop.—Box 472, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOUNDRY TRADE TRAVELLER; disengaged; thoroughly practical in all branches of the Foundry Trade; member I.B.F.; connection Lancashire; age 34.—Box 458, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C 2.

SPECIALIST in Refractories desires post; has sound technical knowledge of uses, also manufacture; has travelled Ganister, Bricks, etc., in London, lower Midlands and South of England; excellent testimonials; would accept office or outside position.—Box 488, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

GENTLEMAN, with sound knowledge of Foundry procedure, Buying Markets, desires post; fully conversant with works and office routine; also has travelling experience.—Box 490, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

PATENTS & TRADE MARKS.

CASTING METAL IN PERMANENT MOULDS.

PATENT No. 174,916.

THE OWNERS of the above Patent offer to grant Licences or to Sell the Patent outright on reasonable terms.

By means of the invention soft and readily workable castings can be obtained from permanent moulds.

Will those interested kindly write in the first instance to Harold Baron, Thanet House, 231 & 232, Strand, London, W.C.2.

PATENT YOUR INVENTIONS, Trade-mark your Goods, Advice, Handbook and Cons. free.—B. T. King, C.I.M.E. (Regd. Pat. Agent, G.B., U.S.A., and Can.), 146A, Queen Victoria Street, E.C.4. 38 years' refs. 'Phone 682 Central.

TENDERS.

CITY OF NOTTINGHAM.

THE TRAMWAYS COMMITTEE are prepared to receive Tenders for the supply and delivery of 150 tons of STEEL TRAMWAY RAILS.

Copies of the Specification and Form of Tender may be obtained on application to Mr. T. Wallis Gordon, City Engineer and Surveyor, Guildhall, Nottingham, on payment of a deposit of One Pound, which will be returned on receipt of a bona-fide tender.

Sealed Tenders, in the official envelope provided, are to be delivered to the undersigned not later than Six p.m. on WEDNESDAY, the 21st OCTOBER, 1925.

The lowest or any Tender will not necessarily be accepted, and Tenders will only be accepted from firms who conform to the conditions of the contract as regards paying the local standard rate of wages, etc.

By Order.
W. J. BOARD, Town Clerk.

Guildhall, Nottingham.
2nd October, 1925.

AUCTION SALE.

TO BRASS AND ALUMINIUM FOUNDERS AND OTHERS.

WHISTON STREET, DERBY.

MESSRS. J. & W. HEATHCOTE are instructed by the Midland Brass and Aluminium Foundry Company to Sell by Auction, on TUESDAY, 13th OCTOBER, at 2.30 p.m. a small complete

FOUNDRY EQUIPMENT,

including A No. 8 "Empire" Blower, by Alldays & Onions, two "Wright-Morgan" Tilting Furnaces, 300 lbs. capacity. Grinders, small Drilling Machine, Crucibles, Moulding Boxes, Core Stove, Patterns and other Effects.

Full particulars from the Auctioneers, The Mart, Derby.

PROPERTY.

FOUNDRY AND ENGINEERING WORKS FOR SALE, as a going concern; freehold; low rates; present output 30 tons weekly of speciality and general Iron Castings; unique opportunity for good return on capital; present owners retiring from the business, but consider reinvesting capital.—For particulars write Box 470, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

MACHINERY.

FOR SALE.—20-in. and 24-in. Hall's Invincible Sand Mixers; the original and best machine in the market for mixing old and new Foundry Sand, Coal Dust, etc.—Apply Penney & Porter (Eng.), Ltd., Lincoln.

SAND MIXERS.—New and secondhand. Ask us to quote.—W. Brealey & Company, Ltd., Russell Street, Sheffield.

MACHINERY, PLANT, &c.

HORIZONTAL 3-THROW HYDRAULIC PUMP, 4-in. rams, 12-in. stroke, driven by 130-h.p. D.C. Motor.

HORIZONTAL 3-THROW HYDRAULIC PUMP, 3½-in. rams, 12-in. stroke, 1,500 lbs. pressure; by Berry.

VERTICAL TWO-THROW BELT-DRIVEN HYDRAULIC PUMP, 1¾-in. rams, 4-in. stroke; by Berry.

Nearly New 100-tons HYDRAULIC PRESS, 16-in. ram, 3-ft. stroke, 1,500 lbs. pressure; by J. Shaw & Sons.

LANCASHIRE BOILER, 30 ft. x 7 ft. 6 in. diameter; reinsure 120 lbs. pressure.

Nine nearly new LOCO.-TYPE BOILERS, 10 n.h.p.; reinsure 150 lbs. pressure.

Catalogue (6,000 Lots) on application.

THOS W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

CUPOLA for Sale, 5 ft. dia. by 28 ft. 6 in. high, with all modern improvements; new; available immediately at low price.—Box 482, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

MORGAN TILTING FURNACES, 3—1,000 lb., second-hand wanted; must be in good condition and reasonable price.—Write full particulars Sterling Metals, Limited, Coventry.

MISCELLANEOUS.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—Cleghorn & Company, Midland Pattern Works, Spring Gardens, Worcester. Phone 264.

NEW CUPOLA

30" DROP-BOTTOM CUPOLA, by Constructional Co., **new and unused,** with steel charging stage 14'×10'. A bargain, **£65.** Spark arrester and wind belt included; will sell cupola only for **£45, F.O.R. PORTON.**

LADLES—GEARED

30 Cwt. EVANS, New	£24
2 Ton EVANS	£28
5 Ton STEVENSON	£38

BUY FROM ME AND SAVE MONEY.

ALEX. HAMMOND,
FOUNDRY MACHINERY MERCHANT,
"BOXTED," SLOUGH.